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Zinc-Sulphate Nasal Spray in the Prophylaxis of Poliomyelitis

OBSERVATION OF A GROUP OF 4,713 CHILDREN, AGE 3-10 YEARS, DURING AN EPIDEMIC IN TORONTO, CANADA

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DURING an outbreak of poliomyelitis in Toronto which occurred in the months of August, September, and October, 1937, a study was conducted to furnish information concerning the possible prophylactic value of the zinc-sulphate nasal spray, the use of which was suggested by the findings of Schultz and Gebhardt (1) and Peet, Echols and Richter (2). The spray was administered on two occasions with an interval of 10-12 days, the spraying being performed by otolaryngologists with equipment suitable for spraying the olfactory area.

The study was made possible by the Department of Health of Ontario, which endorsed the undertaking and provided through a grant the entire cost. It was made possible, also, by the generous assistance of the Department of Public Health of Toronto, and by the hearty co-operation of the various hospitals of the city with their attending otolaryngologists. The direct responsibility for the conduct of the study was assumed by the Hospital for Sick Children and the School of Hygiene, University of Toronto.

Before presenting the study, certain essential data relating to the occurrence of poliomyelitis in Toronto are reviewed briefly.

Public Health Organization

The organization effected by the Department of Health of Ontario to meet the outbreak throughout the province was exceptionally complete and every assistance was rendered to municipalities. In Toronto, the Department of

Public Health, with the co-operation of the Hospital for Sick Children and the other hospitals of the city, provided diagnostic clinics and hospital treatment for all cases. The accepted public-health procedures were conducted effectively and every effort was made to control the outbreak.

For the administration of public health, the city is divided into eight health districts, having populations varying from 36,000 to 142,000. Each district is organized with a full-time medical officer, a nursing supervisor, and a staff of from 8 to 12 public health nurses. Among the direct responsibilities of the district staff are the school medical and nursing services and the investigation and supervision of cases of communicable diseases.

Previous Occurrence of Poliomyelitis

During the preceding ten years the number of reported cases of poliomyelitis among residents of the city of Toronto was as follows: 1927, 11; 1928, 27; 1929, 36; 1930, 263; 1931, 30; 1932, 49; 1933, 14; 1934, 92; 1935, 42; and in 1936, 23.

Course of the Outbreak

During the months of August, September, and October, 1937, a greatly increased incidence of poliomyelitis occurred in the Province of Ontario, approximately 2,435 cases being reported in a population of 3,600,000. The city of Toronto, population 648,300, suffered severely, 733 cases being reported during those months, with 225 in the adjoining suburban municipalities (population 160,000), a total of 958 in "Greater Toronto". Preliminary figures record 101 deaths in Ontario from poliomyelitis during this period, of which 27 occurred in the city of Toronto and 16 in the suburban municipalities.

Only six cases were reported in Toronto prior to August 1st. It was not until the third week of August that a rapid increase in the number of reported cases occurred. The course of the outbreak is presented in figure I. The largest

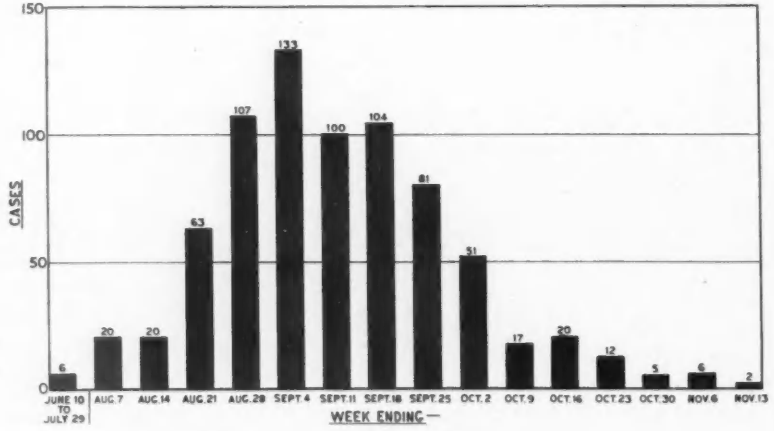

FIGURE I

Reported Cases of Poliomyelitis by Weeks, Toronto, 1937.

number of cases occurred during the first week of September. During the last week of September a marked reduction was noted and during October the incidence steadily waned so that in the last week of October only five cases were reported. To November 16th, eight additional cases were reported, with no deaths.

Since the information presented in this report regarding the trial of the zinc-sulphate nasal spray relates to only a part of the period of the epidemic, the daily number of cases reported in the city of Toronto is presented in table I.

TABLE I

CASES OF POLIOMYELITIS BY DATE REPORTED*
Toronto, June 10–November 16, 1937

Date	Cases	Date	Cases	Date	Cases	Date	Cases
June 10	1	Aug. 25	16	Sept. 22	11	Oct. 20	2
July 12	1	26	13	23	7	21	0
19	1	27	18	24	11	22	1
24	1	28	14	25	8	23	2
29	2	30	40	27	22	25	1
Aug. 3	7	31	30	28	5	26	0
4	1	Sept. 1	6	29	13	27	2
5	4	2	26	30	5	28	0
6	3	3	13	Oct. 1	5	29	2
7	5	4	18	2	1	30	0
9	5	6	28	4	5	Nov. 1	1
10	4	7	15	5	5	2	2
11	4	8	15	6	3	3	1
12	1	9	23	7	2	4	1
13	2	10	12	8	1	5	1
14	4	11	7	9	1	6	0
16	11	13	29	11	1	8	0
17	11	14	16	12	6	9	0
18	12	15	10	13	5	10	0
19	14	16	18	14	5	11	0
20	10	17	21	15	1	12	2
21	5	18	10	16	2	13	0
23	27	20	30	18	4	15	0
24	19	21	14	19	3	16	0

*Cases occurring on Saturday afternoon and Sunday are included in figure for Monday.

Incidence and Mortality

The distribution of the reported cases in the city is presented in figure II. In general the distribution corresponded to the distribution of the population, more cases occurring in the more densely populated central sections.

The irregularity of the city boundaries in figure II indicates that the city streets are continued into the adjacent townships of York (population 71,000), East York (37,000), North York (15,000), Scarboro (21,000), and Etobicoke (14,000), and into the municipalities of Forest Hill, Swansea, Weston, Mimico, and New Toronto. The incidence rate of poliomyelitis (January 1st to November 1st) for the city of Toronto was 1.14 per 1,000 population; for York Township, 1.5; East York, 1.4; North York, 1.6; Scarboro, 0.6; and Etobicoke, 0.1.

The group of children observed in this study consisted of those from 3 to

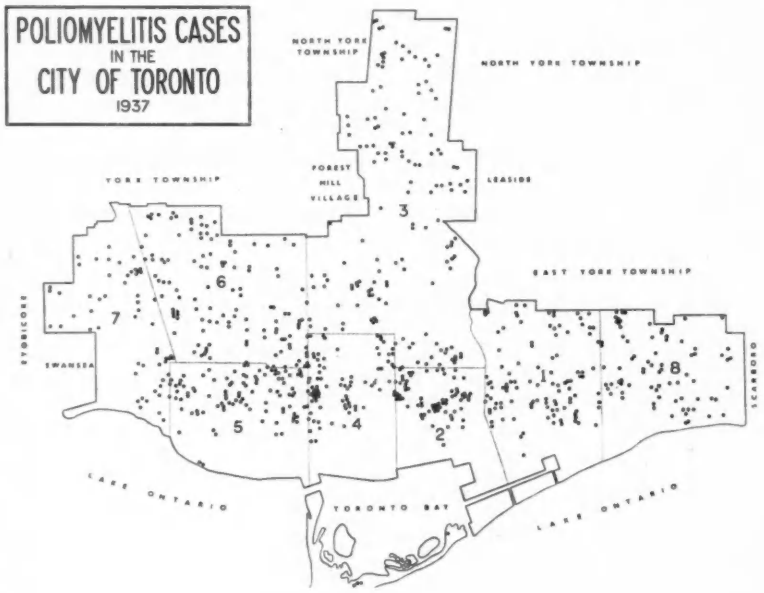

FIGURE II

10 years of age. The number of cases which were reported in the city of Toronto, the number subsequently showing weakness or paralysis, and the the number which resulted fatally, are presented in four age-groups in table II.

TABLE II

CASES AND DEATHS BY AGE
Toronto, January–November 1, 1937

Ages	Cases	Paralysis or Weakness		Deaths	Case Fatality
		No.	Per cent.		
Under 3	83	47	57	3	3.6
3–10	441	240	54	15	3.4
11–19	170	91	54	8	4.7
20+	45	27	60	2	4.4
Total	739	405	55	28	3.8

These data show that in 45 per cent. of the cases no weakness or paralysis was recorded at any time. Preliminary information obtained by the City Department of Health was supplemented by a survey of reported cases undertaken in connection with after-care. Clinical assistance in diagnosis and facilities for lumbar puncture were made available to all physicians in Greater Toronto through the City Department of Health and the Hospital for Sick

Children. Two clinics, one at the Hospital for Sick Children and the other at the Riverdale Isolation Hospital, were continuously operated during the outbreak. At the Hospital for Sick Children 1,775 suspected cases from Toronto and the suburbs were examined and of these 689 were considered to be suffering from poliomyelitis. Among these, 193 cases showed some degree of weakness or paralysis at the time the diagnosis was made. Similar findings were recorded at the Riverdale Isolation Hospital. Spinal-fluid counts were made in all patients examined in the clinics.

THE TRIAL OF NASAL SPRAYING

Based on the assumption that the virus of poliomyelitis enters through the olfactory area of the nasal tract, attempts have been made by several investigators during the past two years to effect a blocking of this portal of entry by the application directly of certain chemicals to the nasal mucosa. Armstrong and Harrison (3) in May, 1935, reported that in monkeys the application of a 4 per cent. solution of sodium alum into the nostrils tended to prevent the disease when active virus was subsequently instilled into the nasal tract. Various chemicals were investigated by these authors and the preventive value of picric acid and picric alum applied to the nasal mucosa was shown in monkeys in which the virus of poliomyelitis was introduced intranasally (4). These findings were confirmed in February, 1936, by Schultz and Gebhardt (5), who had investigated other chemicals in addition to picric acid and alum. An outbreak of poliomyelitis in Alabama during the summer of that year afforded an opportunity for extensive clinical trial of the picric-alum spray. Unfortunately, much of the spraying was done in an unsatisfactory manner with ordinary atomizers. Although it is estimated that more than 2,000,000 persons received the spray in Alabama, Tennessee, and Mississippi, Armstrong (6) was unable to evaluate the results in view of the general unsatisfactory use of the spray.

Continuing their investigations, Schultz and Gebhardt (1) tested no fewer that 40 chemical agents and announced in June, 1937, that of these zinc sulphate, being of simple composition and of relatively low toxicity, seemed worthy of trial in man. More than 240 monkeys were treated intranasally with different concentrations of zinc sulphate in solution and the treated animals were compared with a total of nearly 300 untreated controls. Zinc sulphate was found to afford not only a higher percentage of protection in monkeys than picric-alum in equivalent concentrations, but also a more lasting resistance. The following quotation from their paper presenting two of their later experiments is helpful in considering the period of possible protection:

> "In an experiment now in progress, twelve monkeys were each given one intranasal spray with 1 per cent. solution of zinc sulfate in physiologic solution of sodium chloride. Virus instillations were begun a week later and have been kept up on five successive days each week for seven weeks to date; two additional sprays with zinc sulfate two weeks and four weeks, respectively, after the first treatment have punctuated these virus instillations, the latter being continued without further treatment twenty-seven days after the last spraying with zinc sulfate. Thus far, only two of the animals have succumbed to poliomyelitis, while the disease

has developed in all of the eleven controls with which we started the experiment. In another experiment, in which eight monkeys were given a single intranasal spray with a solution containing 1 per cent. zinc sulfate and a local anaesthetic of 0.5 per cent. Pontocaine . . . and without further treatment were given seven virus instillations from twenty-five to thirty-two days later, seven survived the virus instillations, while all of the eight controls became infected."

In the light of these findings, the authors in discussing the possible use of the spray in man suggested that "the spray be applied at least once every two weeks during times when the risk of infection is great. A more desirable procedure would be to apply the agent on two or three successive days and once every two weeks thereafter. The latter would naturally prove more difficult to carry out in actual practice."

Following a study of the technique of intranasal spraying which would reach the olfactory area and of the discomfort occasioned by the spraying of this area with a 1 per cent. solution of zinc sulphate, Peet and his collaborators (2) recommended that the spray contain 1 per cent. Pontocaine and ½ per cent. sodium chloride. They recommended also that the following method be employed, using an atomizer with a long tip, such as the DeVilbiss No. 156:

"The subject is seated and an attendant holds the head tilted backward almost 45 degrees. This is the usual position for nasal examination. A speculum is introduced into the naris and under direct vision the spray tip is inserted upwards along the septum until definitely past the middle turbinate. If it impinges on the roof of the nose it is slightly withdrawn. The bulb is squeezed the number of times required to introduce 1 cc. of solution. A similar procedure is then carried out on the opposite side of the nose."

From their experiments in which radiopaque substances and certain dyes were used, these authors believe that by this technique the spray is applied directly to the olfactory area. In regard to the number of sprayings and the time interval, they were in agreement with the suggestions of Schultz and Gebhardt. However, they state that "possibly in an extensive field application of the zinc sulphate for the prevention of poliomyelitis a single spray repeated at intervals of two weeks would be sufficient."

Organization

Approval of a plan for a trial of nasal spraying using zinc sulphate having been given by the Department of Health of Ontario on Saturday, August 29th, a plan was immediately presented and approved on the following day by a group of otolaryngologists from the eight hospitals having out-patient departments. It was agreed that special clinics for nasal spraying should be provided at once and that the work should be conducted only by experienced otolaryngologists. It was decided that each child should be sprayed on two occasions 10-12 days apart and that ½ to 1 cc. of the solution be placed in each naris at each spraying. It was further agreed that the study should be limited to 5,000 children in the age-group of 3-10 years. It was felt that it would not be possible quickly to properly spray a larger number and, as the incidence rate is highest in the age-group under 10 years, the age-group 3-10 years was selected. The plan, as presented, provided for the observation of an adequate control group. For this reason also, the limitation to 5,000 was felt necessary,

although it was fully realized that figures of greater significance would be obtained if a considerably larger group could be treated. For the conduct of the study the clinic arrangements were assumed by the Hospital for Sick Children and the organization of the study, including the clerical and statistical work, by the Department of Epidemiology and Biometrics of the School of Hygiene, University of Toronto. The latter work during the period of the clinics was accommodated at the Hospital for Sick Children.

Conduct of the Clinics

Prior to the public announcement of the holding of the clinics a letter outlining the undertaking was sent to all the physicians in the city, reaching them on Monday morning, August 30th. A paid-for announcement was published in the afternoon editions of the two evening newspapers of Monday, and in the morning paper of Tuesday, August 31st. A very conservative statement was made and it was emphasized that the work was being conducted as an experiment and that it would be limited to a group of 5,000 children between the ages of 3-10 years. A request form to be filled out by the parent was included in the announcement. The response was very gratifying. Within three days requests for the spraying of more than 6,000 children were received, the final number being 7,412. Attendance at the clinics was arranged by appointment and notification cards were sent. In addition letters were sent to those who could not be included in the trial.

The first clinics were held on August 31st and the first spraying of 5,233 children was completed on Sunday, September 5th. Forty-four otolaryngologists co-operated in the spraying.

To permit of treating 50-75 children in the period of each clinic, usually 1½ to 2 hours, the following organization was effected. Each child was seen first by an undergraduate nurse who recorded the child's temperature on the back of the original appointment card which the child brought to the clinic. A public health nurse recorded on the card data concerning the present and previous state of health and had the child ready to enter the spraying room. The otolaryngologist was assisted by a graduate nurse. On the same card a record of the success or failure of the spraying was made by a clerical assistant. This latter provision was found to be most helpful as it made certain that the specialist's statement was duly recorded.

In applying the spray the nozzle of the DeVilbiss No. 156 atomizer was used in all the clinics. In most clinics power air pressure was used. Care was taken to see that from ½ to 1 cc. of the solution was discharged.* It was found that the quantity discharged was dependent not only on the pressure but on the quantity of solution in the bottle. Each nozzle was sterilized between use by being immersed in boiling water. The spray solution was prepared in the dispensary of the Hospital for Sick Children and was supplied to each clinic, about 4 ounces of the solution being used in the spraying of approximately 50 children.

*In small children ½ cc. was found most suitable.

The second spraying was commenced on September 13th and was completed on September 16th. In order to allow of the second spraying of children who were unable to keep their appointments for the clinics from September 13th to 16th, an extra clinic was held on September 20th. A personal letter was sent to the parents informing them of the clinics for the second spraying. The response was exceptionally good. This was due, in no small measure, to the excellent publicity given to the study by the press who, through suitable articles and news items, kept the public informed of the purpose and progress of the effort. Of 5,233 children receiving the first spray, 4,585 received the second. Included in the total number receiving the two sprayings were 621 from adjoining suburban areas. Of these 289 were in York Township, 218 in East York, 15 in North York, 21 in Scarboro, 16 in Etobicoke, and the remainder in the municipalities of Forest Hill, Leaside, Swansea, Mimico, New Toronto and Long Branch. Table III presents the essential facts concerning the clinics which conducted the spraying.

TABLE III

DISTRIBUTION OF CHILDREN RECEIVING FIRST AND SECOND NASAL SPRAYINGS BY DAYS

First Clinics			Second Clinics		
Date	No. of Clinics	No. Sprayed	Date	No. of Clinics	No. Sprayed
Aug. 31	4	116	Sept. 13	21	1041
Sept. 1	17	778	14	21	1030
2	21	935	15	22	1046
3	21	1352	16	20	1211
4	20	1372	20	5	257
5	14	680			
Total	97	5233	Total	89	4585

After-Care

Provision for after-care was made. Before leaving the clinic, each child was given a card informing the parents that if the child suffered continued discomfort to call their physician or, if they desired, a physican would be sent. This latter provision was made possible through the co-operation of the City Department of Health.

Test of the Sense of Smell

Following both the first and second sprayings, tests were made to determine the loss of the sense of smell. In all, 909 tests were made, representing 571 children tested once and 169 tested twice (once after each spraying). This testing was conducted in the homes of the children by members of the Division of Public Health Nursing of the City Department of Health.

Selection of Control Group

As previously stated the City of Toronto is divided, for health-administration purposes, into eight districts. Through the assistance, again, of the

Division of Public Health Nursing, the names of all children between the ages of 3 and 10 years resident in appropriately selected sections of each district were obtained by personal calls.

Inclusion of Certain Additional Children in the Sprayed Group

As would be expected, the otolaryngologists of the city were called upon in their private practice to spray a number of children. In addition, some spraying was done by general practitioners. As to the extent of the former definite information was obtained through the co-operation of the group of otolaryngologists who conducted the special spray clinics in the hospitals. Data were kindly supplied concerning children between 3 and 10 years of age who received the spray on two occasions with an interval of approximately 10 days. Reports were received from 24 of these specialists recording the spraying of 749 children. As to the number to whom the spray was administered by general practitioners, some information was obtained. In making the canvass for the control group, the nurses asked if the child or children of the home had been sprayed and, if so, whether this had been done at a clinic or by a private physician. From this representative sample, the number receiving the treatment from general practioners would appear to be negligible. The emphasis placed in the publicity on the necessity for the spraying to be done by those with special training was responsible, doubtless, for this result. Since the requisite information was available and the spraying was done by the same specialists who conducted the clinics, the 749 children treated in private practice resident in Toronto are included in this study.

FINDINGS

Response of the Public

Some doubt was felt concerning the measure of response of the public to the offer of nasal spraying if provided in clinics in the various city hospitals. At that time the outbreak was nearing its peak, and the advice to keep their children away from others was being heeded by all thoughtful parents. There was a hesitancy on the part of many to bring their children to clinics. Further, every effort was made to have it understood that the trial was an experiment although some measure of hope was offered. Within three days of the announcement, requests were received for the spraying of 6,585 children, 827 additional requests being received after the list was closed. As the physicians of the city had been informed by letter of the trial and its arrangements, they were in a position to favourably advise parents seeking their opinion. The help, therefore, of the profession and the co-operation of the press made possible the proper presentation of the effort.

Number Sprayed

In administering the first spray, 97 clinics were conducted, being held from August 31st to September 5th, inclusive; 5,363 attended and of these 130

either were not sprayed or the spraying was considered unsatisfactory,* leaving a total of 5,233 who were considered to have been sprayed satisfactorily.

For the second spraying, 89 clincs were held. Of the 4,864 who attended, 4,585 were recorded as satisfactorily treated.

Composition of the Group Studied

Since it was not feasible to obtain control groups in each of the 12 suburban municipalities, the study is confined to children resident in the city proper. Of the 4,585 receiving 2 sprayings, 3,964 were Toronto residents. To this number is added 749 children who received 2 sprayings by the same specialists, who conducted the hospital clinics, in their private practice, making a total of 4,713. Reference is made separately to the findings in the suburban group.

The Immediate After-effects of Spraying

Most of the children suffered temporary discomfort. Some, however, complained of severe pain "between the eyes," which continued for several hours. Among 5,233 children receiving the first spray, 46 requests were made by parents for a Department of Health physician to call. Almost all of these requests were made within a few hours of the spraying. In the second spraying of 4,585 children, 24 such calls were made. No information is available as to the number of calls received by private physicians but it is unlikely that many were received as the parents had been informed that a visit would be made without charge if a request was made to the Department of Health offices, the telephone numbers being supplied on the card given to each child receiving the spray. In only an occasional case was there any evidence of bleeding indicating intranasal trauma. The return of such a large proportion (88 per cent.) of the children for the second spraying is further evidence of the skill used in administering the spray and the infrequency of any ill effects.

From the records of the physicians' calls the most frequent complaints were headache, nausea or vomiting, and stiffness of the muscles of the neck. An elevation of temperature was also commonly reported. In only a few was a second visit required. The reaction described tended to be more frequent in the older children and the discomfort more pronounced. The illnesses, however, were of short duration, the children often having resumed their play before the physician called.

Occurrence of Poliomyelitis in Sprayed Children

The first spraying extended over the period August 31st to September 5th, the median day being September 3rd. The second spraying extended from September 13th to 16th (a supplementary clinic being held on September 20th). In the sprayed group all cases occurring 6 days or more after the first spraying and within 30 days after the second spraying are presented in figure III.

**Unmanageable children and those with nasal defects, apparent illness, or a temperature of 101° F. or over.*

Eleven cases occurred as follows: Sept. 9th (1)*, Sept. 16th (1), Sept. 17th (3), Sept. 21st (1), Sept. 23rd (2), Sept. 24th (1), Sept. 29th (1), Sept. 30th (1).

Occurrence of Poliomyelitis in the Control Group

This group consisted of 6,300 children in the age-group 3-10 years. The 19 cases which occurred 6 days or more after the median day of the first spraying (September 3rd) are as follows: Sept. 9th (1)*, Sept. 10th (1), Sept. 13th (3), Sept. 14th (1), Sept. 17th (1), Sept. 20th (2), Sept. 21st (2), Sept. 24th (1), Sept. 25th (2), Sept. 27th (1), Sept. 29th (1), Oct. 7th (1), Oct. 13th (1), Oct. 14th (1).

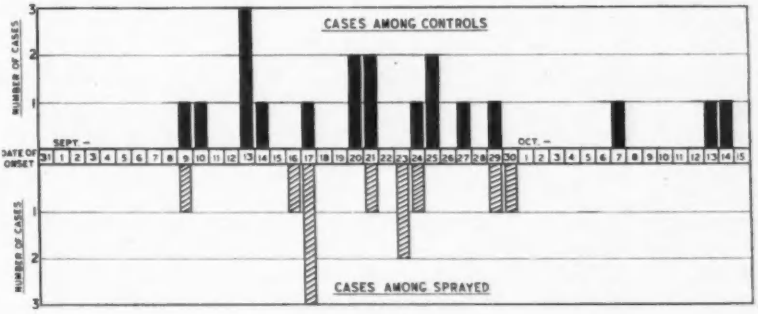

FIGURE III

Incidence of Cases Among Sprayed and Control Groups.

In control group the median day of the first spraying was September 3rd, and the cases have been recorded from this date.

First clinic—Aug. 31st to Sept. 5th. Second clinic—Sept. 13-16th and Sept. 20th.

Data concerning the cases of poliomyelitis among the children receiving the spray and among the control group are presented in tables IV and V.

TABLE IV

SYMPTOMS AND SIGNS OF POLIOMYELITIS IN THE SPRAYED CHILDREN

Name	Age	Temp. on adm.	Head-ache	Nausea or vomit-ing	Naso-pharyn-gitis	Pain or stiffness in neck	Pain or stiffness in back	Spinal-fluid cell-count	Paralysis
P.B.....	6½	102	+	+	+	+	+	460	Slight — left arm, left leg, back
M.C.....	9	101	+	+	+	+	+	70	No paralysis
M.F.....	8½	104	+	+	+	+	−	44	Both legs and right arm
B.F.....	4	101.5	−	−	+	+	−	35	No paralysis
K.F.....	9	100.8	+	+	+	−	−	108	No paralysis
H.F.....	10	101	+	−	+	+	−	165	Left ankle—slight
J.P.....	7	99.6	−	+	−	+	−	20	Right leg
E.P.....	3	99.6	+	+	−	+	+	110	No paralysis
D.R.....	7	99.2	+	+	+	+	−	36	No paralysis
S.T.....	8	103	+	−	+	+	+	13	No paralysis
A.H.....	6	103.2	+	−	−	+	+	64	No paralysis

**The two cases of Sept. 9th, one in the sprayed group and one in the control group, were not included in the analysis.*

TABLE V

SYMPTOMS AND SIGNS OF POLIOMYELITIS IN CHILDREN IN THE CONTROL GROUP

Name	Age	Temp. on adm.	Head-ache	Nausea or vomit-ing	Naso-pharyn-gitis	Pain or stiffness in neck	Pain or stiffness in back	Spinal fluid cell count	Paralysis
G.H.	5	102.2	−	−	−	+	+	262	Slight weakness of right arm
D.N.	5	103	−	−	+	+	+	40	Slight paralysis of palate and right forearm
B.C.	8	102.3	+	−	+	+	−	244	Slight paralysis of right forearm
R.B.	7	101.2	+	−	−	+	+	22	No paralysis
B.H.	3	101	−	+	+	+	−	65	No paralysis
P.B.	4½	100.4	+	+	+	−	−	54	No paralysis
J.M.	3	103.4	+	−	+	+	−	45	Bulbar paralysis
J.W.	9	99.6	−	+	+	+	+	72	No paralysis
K.H.	7	101.2	−	−	+	+	−	180	No paralysis
B.S.	9	101	+	+	+	+	+	50	No paralysis
E.P.	7	103	−	+	−	+	+	230	No paralysis
R.W.	5	101	+	−	+	+	+	390	Left arm and both legs
N.B.	4½	101	+	+	−	+	−	14	No paralysis
K.C.	8	99.8	−	−	+	+	−	25	Sl. facial and bulbar paralysis
E.O.	10	99.6	+	+	+	+	−	170	Sl. facial and bulbar paralysis
H.B.	5½	102.2	−	+	−	−	+	68	Right arm
G.V.	5	98.4	−	+	−	+	+	40	Left arm
K.W.	7	101.2	+	+	+	+	+	125	Weakness rt. arm and leg
F.T.	3	100.4	−	−	−	+	−	33	Weakness rt. arm

Comparison of the clinical facts regarding the cases in the two groups can be made readily from the data in tables IV and V. Four of the 11 children (36 per cent.) in the sprayed group and 11 of the 19 (58 per cent.) in the control group developed some degree of paralysis.

In these two groups of children, there is only one child in the sprayed group with a cell count below 20, and although this child did not develop any paralysis, she had typical symptoms, namely, headache, pain in the neck and pain in the back, and the typical spine-sign of poliomyelitis. In the control group there is also one child with a cell count under 20, and although he did not have a spine-sign, he had elevation of temperature, headache, vomiting and stiffness of the neck. In the two groups there would appear to be no question, with the exception of the above-mentioned two cases, of the diagnosis. They were all examined by the staff of the Hospital for Sick Children or of the Riverdale Isolation Hospital.

Among the sprayed children a child (D.M.), aged 6 years, had an illness with a temperature of 101°F., with typical pain and stiffness of the neck and lower part of the back. Examination of the spinal fluid, however, showed the cell count to be normal. As no paralysis developed and as no further spinal puncture was done, it was considered best to exclude it from the list of cases. It is possible, however, that this was a case of poliomyelitis.

Loss of the Sense of Smell

As previously mentioned, tests were made on three occasions. In the first instance, 330 children were tested, representing 18 of the clinics conducted on September 3rd. The tests were made on September 4th. Oil of cloves was used and the public health nurses were asked to determine if the children were able to detect any odour. No attempt was made to control the trial by asking the child to identify the odour, although some children did so. Only 44 (13 per cent.) appeared to have lost their sense of smell on both sides. Analysis of the findings according to age of child and by clinics indicated that the results were practically the same in the various ages and clinics.

A second survey was made in which the children were asked to identify oil of cloves and oil of spearmint, a control substance without odour being included. Children numbering 187 were selected, representing various clinics. They had been sprayed on either September 4th or 5th and the tests were made on September 6th or 7th, 48-72 hours after spraying. Excluding the cases in which the control test was incorrect, the sense of smell was lost in 13 of 138 (10 per cent.) or if doubtful cases be included, 14 per cent.

A third study was undertaken after the second spraying. Oil of spearmint was used, and a non-odorous control. There were 391 children tested in this survey and with the exception of younger sprayed siblings the group was limited to children age 6-10 inclusive, sprayed for the second time on September 15th or 16th, in the belief that better co-operation and a more accurate statement could be obtained from them than from the younger group. This time a sample of those tested after the first spraying was included as well as others not tested before. The test was carried out on September 17th and 18th, 48-96 hours after spraying.

Excluding cases in which the control test was incorrect, 51 out of 268 (19 per cent.) were recorded as having lost their sense of smell. If the three doubtful cases are included and as well as those in whom the control test was incorrect but the sense of smell possibly absent or doubtful, 95 out of 391 (24 per cent.) might be recorded as having lost the sense of small. These proportions are higher than in the other series, perhaps because the test was simplified or the technique improved.

DISCUSSION

Two questions naturally arise: (1) Is this method of nasal spraying a practical public-health procedure in the control of poliomyelitis? (2) Is the zinc-sulphate nasal spray applied in accordance with the technique described, an effective measure in the prevention of poliomyelitis?

(1) *Is the Method of Nasal Spraying a Practical Public-Health Procedure?*

A definite answer can be given to this question. Since the procedure requires to be conducted by otolaryngologists or physicians with special training in intranasal work, it is obvious that a serious limitation is placed

upon its usefulness as a public-health procedure. Conducting the work with every facility and with skilled assistants, it was possible for each specialist to spray from 50 to 75 children in the usual clinic period of an hour and a half*. No attempt was made to spray children suffering with nasal defects. No preliminary shrinkage of the mucosa was undertaken. A freshly-sterilized nozzle was used for each child but the additional time required for changing the nozzles was compensated by the clerical assistant doing the recording. The experience in Toronto has made clear that the spraying even of as small a group as 5,000, when carefully done, represents an amount of work which would render impossible the treatment of many thousands, particularly when the spraying must be done within a few days and repeated, at least once, during the period of the outbreak.

In reference to the administration of the spray on three successive days as originally suggested by Schultz and Gebhardt and by Peet and his associates, few children would permit of being sprayed daily for three days, particularly as many suffered considerable discomfort and the younger children were so disquieted by the procedure that it was with difficulty that they were brought to the clinic after an interval of 10 days for the second spraying. To attempt more frequent spraying would remove the procedure completely from the bounds of possible use on a large scale.

Peet and his collaborators believe that their method is successful in covering the olfactory area. They point out that the sense of smell is usually lost when the olfactory area is sprayed. If the criterion of satisfactory spraying is the loss of the sense of smell, then the evidence in Toronto would indicate that the single spraying accomplished this in not more than 25 per cent. of the children. It is true, of course, that the testing for anosmia was done in the field and not in clinics with special facilities, yet the tests being repeated on three occasions indicate that the great majority of the children retained their sense of smell. Since children sprayed by more than 30 otolaryngologists were tested and the results were quite uniform, there is every reason to believe that the prescribed technique was carefully followed. The specialists who conducted the work expressed their opinion that the olfactory area was satisfactorily reached by the spray in the great majority of cases.

The effectiveness of the technique used has been questioned by Pentecost who, as one of the co-operating otolaryngologists, observed the work at first-hand. In a paper recently published (7) he recorded the loss of the sense of smell in a group of 100 children sprayed by him using the technique of this study, finding anosmia in only 24 per cent. He concluded that at least part of the olfactory area was not covered by the spray. He has suggested an improved technique by which he believes the olfactory area is completely covered as evidenced by anosmia in 100 per cent. of the cases. Using an olive-tipped catheter of such a size as is suitable for the child's age and a 1 cc. syringe, he reports that it is possible to inject the quantity of solution desired without difficulty. The average length of time required for the

**In conducting the clinics minor delays were usually encountered which resulted in an average of 50 children per clinic.*

injections was one minute and ten seconds. It is necessary to partially anaesthetize and shrink the nasal mucosa by spraying with a solution of 0.25 per cent. Pontocaine and 0.25 per cent. ephedrine five minutes prior to the application. In making the nasal injections the patient is placed in a dorsal recumbent position and the head is maintained in the extended position for approximately one minute. It is his belief that the technique is such that a general practitioner can become skilled in it in a few days.

It was regretted that it was not possible to undertake a study of this technique. At the time this method was described, the second spraying of the group had commenced. It was essential, of course, that the spraying be completed without change in method, if data concerning its possible value were to be obtained.

(2) *Is the Zinc-Sulphate Spray Effective when Used according to the Prescribed Technique?*

Comparability of the Control Group. The method employed in obtaining the control group, namely of taking city blocks or sections of streets as units in conducting the canvass, provided a reasonably representative group. Figure IV indicates the location of the control group in the city as a whole.

The distribution of the sprayed and control groups according to the eight health districts of the city is presented in table VI. Similarly the age distribution of the two groups is given in table VII.

FIGURE IV

Distribution of Control Group in City.

TABLE VI

DISTRIBUTION OF SPRAYED GROUP AND CONTROL GROUP BY HEALTH DISTRICTS

District	Sprayed				Control	
	Clinics	Private Practice*	Total	Per cent.	Number	Per cent.
1	477	37	514	11	708	11
2	285	4	289	6	825	13
3	589	283	872	19	893	14
4	605	156	761	16	786	12
5	534	88	622	13	782	12
6	635	96	731	16	848	14
7	299	47	346	7	738	12
8	540	38	578	12	720	12
Total....	3,964	749	4,713	100	6,300	100

*Performed by same group of specialists.

TABLE VII

AGE DISTRIBUTION OF SPRAYED GROUP AND CONTROL GROUP

Age	Sprayed				Control	
	Clinics	Private Practice*	Total	Per cent.	Number	Per cent.
3	407	76	483	10	674	11
4	446	90	536	11	752	12
5	455	77	532	11	872	14
6	548	90	638	14	850	13
7	578	113	691	15	907	14
8	538	114	652	14	800	13
9	509	90	599	13	798	13
10	483	99	582	12	647	10
Total....	3,964	749	4,713	100	6,300	100

*Performed by same group of specialists.

Incubation Period

The incubation period in man is not definitely known. It is probable that it is not less than 6 or more than 18 days. It is generally considered that it is usually from 7 to 14 days. Wickman (8) considered that 6 to 10 days was the likely incubation period. Aycock and Luther (9) concluded that the apparent incubation falls within a period of from 6 to 20 days.

In this study it was decided to exclude any cases occurring within 7 days of the first spraying. A case that occurred on September 9th, 6 days after the first spraying, and which is shown in figure III, is not included in the analysis.

Analysis of the Data

The analysis of the data is presented in the form of four summaries relating to residents in Toronto:

(1) Cases occurring 7 days after the first spray and 10 days after the second spray (table VIII).

(2) Seven days after the first spray to 20 days after the second spray (table IX).

(3) Seven days after the first spray to 30 days after the second spray (table X).

(4) Including the suburban group, cases from 7 days after the first spray to 30 days after the second spray (table XI).

TABLE VIII

CITY CASES OCCURRING 7 DAYS AFTER 1ST SPRAY* TO 10 DAYS AFTER 2ND SPRAY*
September 10–25th

	Sprayed Group	Control Group	Total for City	City excl. Sprayed
Number of children	4,713	6,300	82,000†	77,287
Number of cases	8	13	114	106
Rate per 1,000	1.7±0.6	2.1±0.6	1.4	1.4

Difference between control and sprayed groups 0.4
S.E. of Difference 0.8

TABLE IX

CITY CASES OCCURRING 7 DAYS AFTER 1ST SPRAY* TO 20 DAYS AFTER 2ND SPRAY*
September 10–October 5th

	Sprayed Group	Control Group	Total for City	City excl. Sprayed
Number of children	4,713	6,300	82,000†	77,287
Number of cases	10	15	142	132
Rate per 1,000	2.1±0.7	2.4±0.6	1.7	1.7

Difference between control and sprayed groups 0.3
S.E. of Difference 0.9

TABLE X

CITY CASES OCCURRING 7 DAYS AFTER 1ST SPRAY* TO 30 DAYS AFTER 2ND SPRAY*
September 10-October 15th

	Sprayed Group	Control Group	Total for City	City excl. Sprayed
Number of children	4,713	6,300	82,000†	77,287
Number of cases	10	18	156	146
Rate per 1,000	2.1±0.7	2.9±0.6	1.9	1.9

Difference between control and sprayed groups 0.8
S.E. of Difference 0.9

The differences noted between the attack rates in the sprayed group and control group are not statistically significant.‡ These data do not suggest any preventive value of the nasal spraying as conducted.

The attack rate in the combined city and suburban group of 5,492 children is 1.8. The data are presented in table XI.

*From median day,—1st spray Sept. 3rd; second spray Sept. 15th.
†Population of age-group 3-10 years as estimated for 1937 from the Census of 1931.
‡Difference is less than twice the standard error.

TABLE XI

INCIDENCE OF CASES IN CITY AND SUBURBAN GROUP, FROM 7 DAYS AFTER 1ST SPRAY TO 30 DAYS AFTER 2ND SPRAY

September 10–October 15th

	Sprayed Group	Control Group
Number of children	5,492	6,300
Number of cases	10	18
Rate per 1,000	1.8±0.6	2.9±0.6
Difference between control and sprayed group	1.1	
S.E. of Difference	0.9	

The difference in the attack rates in the sprayed and the control groups in the combined city and suburban group of 5,492 children is also not statistically significant.

SUMMARY

An outbreak of poliomyelitis which occurred in Toronto during the months of August, September, and October, with an incidence rate of 1.1 per thousand population, afforded an opportunity for a trial of a nasal spray containing 1 per cent. zinc sulphate, 1 per cent. Pontocaine, and 0.5 per cent. sodium chloride. In the spraying, ½ to 1 cc. of solution was introduced into each naris and the spraying was done on two occasions with an interval of approximately 12 days. The spraying was done according to the technique of Peet, Echols and Richter but differed from their recommended procedure in that it was not administered on three successive days since it was considered that it would not be practical to do so. The peak of the epidemic occurred during the week ending September 4th. The first spraying was commenced on August 31st and completed by September 5th. The work was done by the attending otolaryngologists, 44 in number, of eight hospitals in the city. Ninety-seven clinics were held. The staff of each clinic consisted of an otolaryngologist, a graduate nurse as assistant, a clerical assistant for recording the spraying, a public health nurse for recording personal data concerning the child, and an undergraduate nurse for taking the child's temperature. In the period of one week from the authorization of the study, 5,233 children had received the first spraying, indicating the success of the presentation to the public and the efficiency of the organization. The second spraying extended from September 13th to September 16th and supplementary clinics were held on September 20th, a total of 89 clinics being held. The work was conducted without the occurrence of any complications, the immediate after-effects seldom giving discomfort for more than twenty-four hours. In less than 1 per cent. requests were made by the parents for a physician, provided by the clinics, to call to see the child after the spraying. The absence of any accidents or complications is evidence of the skill of the attending otolaryngologists in treating such a large number of young children in such a short period of time.

Nine hundred and nine tests, representing 740 children, were made to determine the number who had lost their sense of smell. From these observations it would appear that not more than 25 per cent. had anosmia (loss of sense smell). If loss of sense of smell be accepted as a criterion of the complete covering of the olfactory area with the spray, the experience in this study would indicate that the method followed did not satisfactorily achieve its purpose. In the opinion, however, of the attending otolaryngologists, the olfactory area was satisfactorily sprayed in the great majority of the children.

A representative control group of 6,300 children was obtained in the city proper. As suitable control groups could not be obtained in the 12 suburban municipalities, 621 children resident in these municipalities who received the two sprayings in the clinics and 158 in private practice were not included in the analysis. Included in the study, however, were 749 children who were sprayed by the same group of otolaryngologists in their private practice and concerning whom satisfactory data were obtained, making a total of 4,713 children resident in Toronto.

Among the 4,713 children who were sprayed, 11 cases occurred to October 12th, 30 days from the second spraying. One of these occurred 6 days after the first spraying and was not included in the analysis. In the control group of 6,300 children, 18 cases occurred during the period. The attack rate in the period 7 days after the first spraying to 10 days after the second spraying was 1.7 per 1,000 in the sprayed group and 2.1 in the control group; in the period 7 days after the first spraying to 20 days after the second spraying, 2.1 in the sprayed group and 2.4 in the control group; and in the period 7 days after the first spraying to 30 days after the second spraying, 2.1 in the sprayed group and 2.9 in the control group. The differences between the attack rates in the sprayed group and the control group were not statistically significant. In the suburban group, which included 621 children sprayed in the clinics and 158 in private practice, no cases were found to have occurred.

In the total of the city and suburban groups the attack rates for the period 7 days after the first spraying to 30 days after the second spraying were 2.9 in the control group and 1.8 in the sprayed group. This difference also was found not to be statistically significant.

CONCLUSIONS

1. This study furnishes no evidence of the protective value of a nasal spray containing 1 per cent. zinc sulphate, 1 per cent. Pontocaine and 0.5 per cent. sodium chloride, when ½ to 1 cc. of the solution was sprayed into each naris on two occasions with an interval of approximately 12 days, the spraying being performed by otolaryngologists with equipment suitable for spraying the olfactory area.

2. As the spraying employing the method used in this study must be conducted by otolaryngologists or other physicians specially trained in intranasal treatment, requires special facilities, and cannot be done sufficiently quickly to meet the emergency of an outbreak, it cannot be considered a practical public-health procedure.

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PUBLIC ANNOUNCEMENT AND SOME OF THE RECORD CARDS

Child's Name ..... Age ..... Sex .....
Parents' Name .....
Address .....
Telephone .....
Arrangements have been made for your child to receive the spray treatment at the ..... Hospital,
..... on ..... at .....
(date) (time)
You will kindly go to the Special Clinic provided for this purpose at the
..... Department.
This card must be presented at the Clinic.

Has child had any illness in past two weeks? .....
Is child well now? .....
Remarks by nurse .....

Chair .....
Temperature of child .....
Spraying done by .....
.....
Spraying satisfactory?
Yes ..... No .....
Unable to complete .....

Address .....
Child's Name ..... **Age** .....
Parent's Name .....
Attended Clinic at ..... **On September** .....

SENSE OF SMELL

Sample	Left Side		Right Side	
	PRESENT (State odor if identified)	ABSENT	PRESENT (State odor if identified)	ABSENT
1				
2				

P. H. Nurse (Initials) ..... **District** .....

As in the previous spraying, if discomfort continues or there is any occasion for medical advice, it is suggested that you call your own physician or the Division of Medical Services, City Hall (ADelaide 7171), from 9 a.m. to 5 p.m. or GErrard 1334 after 5 p.m.

INFANTILE PARALYSIS
FACILITIES FOR NASAL SPRAYING

Experimental work appears to offer some hope that the proper application of a solution of certain chemicals high up in the nose may afford protection against poliomyelitis. Adequate trial, however, of this method has not yet been made and its value can be learned only by careful observations during the presence of a large number of cases.

As the spray is harmless, with only an occasional child suffering some temporary discomfort, it is believed that many parents may wish to co-operate in a study to determine its possible value. Facilities are being provided through funds made available by the Department of Health of Ontario, and arranged by the Hospital for Sick Children and the School of Hygiene, University of Toronto. The work is being made possible through the hearty co-operation of the nose and throat specialists and the authorities of the various Toronto hospitals. To permit of proper observation the group will be limited to 5,000 children from 3 to 10 years of age resident in Greater Toronto. One treatment will be given to each child by a nose and throat specialist as soon as possible and subsequent treatment at intervals of two weeks if the conditions warrant. Information regarding the effectiveness of the treatment in each child will subsequently be obtained from the parents.

If as a parent you desire to have your children 3 to 10 years of age given this treatment:

(1) **Complete the request form printed below and sign it.**
(2) **MAIL IT IMMEDIATELY, OR BRING IT,** to the Hospital for Sick Children (front door, College Street), as only the first 5,000 requests can be accepted.
(3) **A card of admission to the clinic will be sent to you immediately,** telling you to which hospital to go and the time.

The work is conducted without charge.
NOTE: No children will be treated at any of these clinics without appointment and NO APPOINTMENTS WILL BE MADE BY TELEPHONE. Do not bring your children without the appointment card which will be sent to you when the signed request form is received.

Request Form For Nasal Spraying

Names of Children	Age
.....	.....
.....	.....
.....	.....
.....	.....
.....	.....

I hereby request that the above-mentioned (child) (children) be given the nasal spray treatment as arranged by the Hospital for Sick Children. I understand that the treatment will be given shortly and subsequent treatments at intervals of two weeks if the outbreak continues.

Telephone No. ..... Signed .....
Parent or Guardian
Date ..... Address .....

CONTROLS

Address .....
Name of Parent .....

CHILDREN 3-10 YEARS

NAME	AGE	SPRAYED BY FAMILY PHYSICIAN	SPRAYED BY CLINIC

Remarks (see reverse side).

Some Causes of Malnutrition*

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IN order to clarify this discussion it is advisable to define certain terms. Nutrition is the nourishment of the living organism. Optimal nutrition is the provision of the kinds and quantities of foods best suited for the individual in question. The word malnutrition is used here in the literal sense, bad nutrition, and means any deviation of nutrition away from the optimum as regards either quality or quantity.

There is today among scientific workers in nutrition, good agreement as to the composition of an optimal diet. The first consideration is that the total quantity of food should be sufficient to satisfy energy requirements, the energy being provided by the utilization of proteins, fats and carbohydrates.

Protein supply is of great importance, not only with regard to quantity but with reference also to the nutritional quality of the proteins used. Since animal proteins are dietetically better than those from plants, at least a third of the total protein should come from such foods as milk, meat, and eggs.

Fats and carbohydrates are not interchangeable sources of energy and a number of reasons could be cited to show that the diet should contain a fair amount of fat. To mention only one, a meal containing appreciable fat is digested more slowly than one with little fat and the slower digestion prevents the premature return of hunger. Since a relation could easily be traced between contentment and the amount of fat eaten, the supply of fat may become a matter of political concern.

While many different constituents must be supplied in the diet, special attention should be given to certain minerals, such as iron, calcium and iodine, and to the essential vitamins. To prevent deficiency conditions it is necessary to include in the diet protective foods like milk, eggs and fruit which are good sources of minerals and vitamins.

Granted that the consumption of an optimal diet, such as has been rapidly outlined, would be an advantage in improving health and efficiency, we are faced with the question as to whether all Canadians are consuming or could consume optimal dietaries. Canadian food resources are, or could be made, sufficient to give all Canadians such a dietary. If this ideal could be attained there would be no malnutrition. Unfortunately several factors operate against the accomplishment of this ideal condition.

The first basic cause of malnutrition is a lack of nutritional knowledge.

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This implies not only information necessary to choose the proper foods but also knowledge of how to cook the chosen foods. Nutritive values of foods can be seriously impaired during cooking. Moveover, food should be prepared so as to be attractive in flavour and appearance to stimulate the appetite. A great deal could be said in praise of good cooking.

During the past few years there has been a marked increase in nutritional teaching and we have already seen beneficial results. Present-day children are generally better nourished than those of even a generation ago. There has been an encouraging increase in the use of fruits and vegetables. The depression has increased public interest in nutrition and this has made possible feeding of large groups of people without a demonstrable increase in malnutrition.

Nutritional teaching could be extended and improved in several directions. Many of us would like to see some basic facts about nutrition taught in the public and secondary schools. There is nearly as good a reason for teaching good food habits as there is for the installation of expensive swimming pools and gymnasia to teach children how to swim or play. It is unfortunate that medical students are often given little instruction in nutrition other than the dietetic treatment of disease. Medical students in their final year are frequently at a loss as to where to find information regarding food values. Extension of nutrition teaching in these fields would make easier the education of the general public.

In any program of nutritional education care should be taken that instruction is practicable and based on sound scientific evidence. We need no teaching based on fad or fancy. Unfortunately, with all the reliable nutritional information that is available, a great deal of misinformation is broadcast. This not only prevents the spread of accurate knowledge but frequently causes people to feel sceptical about scientific work in nutrition.

At present there is a deluge of pseudo-science in advertisements and claims not based on any scientific evidence are frequently made regarding products. No longer is it sufficient for food products to be wholesome and tasty; they must allegedly contain vitamins and minerals. There are even cosmetics with added vitamins to cure ills not combated by food manufacturers. This type of advertising misleads the public and tends to cast discredit on the careful scientific work which has made possible remarkable advances in our knowledge of the vitamins.

Last spring, in an address given before the American Institute of Nutrition, Dr. James McLester said that he considered dietary fads to be a leading cause of malnutrition in the United States. Possibly this factor is not so serious in Canada but it merits some attention. Adherence to dietary fads is a sad result of a lack of nutritional knowledge. An interesting point about these fads is that they are generally taken up by educated people who should know better.

There are two dietary fads which are popular in Ontario and which have a good deal in common. Both are sponsored by erstwhile physicians and both are based on unphysiological principles. They teach that proteins and carbohydrates should not be eaten together since proteins require an acid medium for

digestion, while carbohydrates need an alkaline one. Unfortunately our bodies are not aware of this and are designed to handle mixed meals without difficulty. A second principle is that there are so-called natural foods which contain vital properties. A grain of wheat is such a food and its value can be proved by planting and watching it grow. On the same basis peach stones should be good food. These authorities teach that milk is not a good food and that pasteurized milk is of little value. Adherence to dietary fads such as these contributes to malnutrition and, from the public health standpoint, is highly undesirable.

There is no doubt that nutritional education has accomplished a great deal and much more could be done but one must be prepared for slow progress and many failures. Human beings, constituted as they are, present problems for any type of education. Under present conditions there is a barrier to optimal nutrition which cannot be surmounted by education, namely, that many people cannot afford to buy desirable foods in recommended quantities. Financial inability to purchase is the most difficult obstacle to optimal nutrition. This may well be illustrated by reference to two recent reports, one dealing with conditions in Great Britain, and the other with Canadian problems.

Last year Sir John Orr of Aberdeen published a report with the suggestive title, "Food, Health and Income". The principal results of this study of British nutrition may be rapidly summarized. An examination of the diets of different financial groups showed that the degree of adequacy of the diet increased as incomes rose. The average diet of the poorest group, comprising 4½ million people, was deficient in every constituent examined. To make the diet of the poorer groups the same as that of the first group whose diet was adequate for full health would involve increases in consumption of a number of the more expensive foodstuffs, namely, milk, eggs, butter, fruit, vegetables and meat, varying from 12 to 25 per cent. A review of the state of health of the people of the different groups showed that, as income rises, disease and death-rate decrease, children grow more quickly, adult stature is greater and general health and physique improve.

In considering Canadian conditions we are handicapped by a dearth of information. No extensive dietary surveys have been made in this country. Such information as is at our disposal indicates that, while plentiful supplies of food are available in Canada, all Canadians are not able to buy some foods in desirable quantities.

In 1935 the Dominion Department of Agriculture conducted a survey of milk consumption among 3,213 families in Quebec, Ontario, and Alberta. There was a very apparent relation between consumption and financial income, poor families using about one-half the desirable quantity of milk. It may be said that a contributing factor was a lack of appreciation of the value of milk by these families. A more likely explanation is that they could not afford to buy larger quantities. The optimal amount of milk for a family of five in Toronto would cost at present $1.78 per week, which is 10 per cent. of a $900 income. A poor family cannot afford to spend that amount on milk alone. Data from this survey

showed that 33 per cent. of the children in the poorest families were not receiving milk to drink.

A survey of the consumption of protein foods by families in several Canadian cities in 1935 showed that poor people used appreciably less meat and eggs but did consume more cheese than wealthier families. While the greater consumption of cheese was an advantage in supplying protein and calcium, the amount used was not sufficient to offset the decrease in meat and eggs, nor would it furnish the iron and vitamins supplied by those foods.

A poor family's difficulty in securing an adequate diet may be illustrated by considering the cost of several recommended diets. Last October in a report from a Dominion Government Committee there was described a low-cost diet. This was designed for a family of five with an income of $700 per year and cost in Ottawa in March, 1936, $5.98 per week, which is 45 per cent. of the income. This diet, while supplying adequate energy, is unattractive and is deficient in iron, calcium, and most of the vitamins, particularly C. The diet recommended several years ago by the Committee on Nutrition of the Ontario Medical Association, is adequate but not particularly attractive. The cost of this diet in Toronto on October 15, 1937, for a family of five was $8.54 per week, which is 63 per cent. of a $700 income. Obviously such an expenditure for food would be difficult if not impossible. This amount is appreciably greater than the Toronto relief allowance.

It has been pointed out that scientific information, acceptable to most workers in the field of nutrition, is available to guide individuals in choosing an optimal diet. The general application of such teachings would tend to raise the level of health, and would solve some of our agricultural problems by increasing consumption. Education will do much to promote the use of such a diet and should be encouraged but, in many cases, poverty will prevent the purchase of an optimal diet. To overcome this obstacle no panacea is available. A thorough study of the problem would amply repay the cost.

Some Physiological Aspects of Health*

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THE human individual begins life with inherited characteristics. Subsequently, environmental influences modify these inherited physiological and psychological characteristics. Environment has been divided by Claude Bernard into the external environment in which the organism lives and the internal environment in which the tissue elements live. But these are not really physiologically separable, for one depends on the other. The external environment includes climatic conditions, occupation, recreation, nutrition, muscular exercise, hygienic and mental influences.

INFLUENCE OF THE ENVIRONMENT ON THE INDIVIDUAL

The more one studies physiology the more one becomes impressed by the wonderfully balanced mechanisms which maintain the body in health. Living protoplasm is characterized by its irritability and its ability to respond to stimulus. For the whole body the environment acts as the stimulus and the reaction of the organs and tissues is the response. The central nervous system with its peripheral nerves, the autonomic nervous system and the glands of internal secretion, by means of their hormones, are all concerned in the performance of these physiological functions. In health all these are co-ordinated.

Granting, then, that one has been born with an inheritance of good mental and physical health, further development depends on the effects of external environment. It is quite obvious that the more we know concerning ideal environmental conditions and the more we apply that knowledge and avoid harmful stimuli, the better will the whole organism develop. The acquisition of knowledge of physiology, hygiene and psychology and the correct application of this knowledge by the individual are important aims of preventive medicine.

Nutrition

Of all environmental conditions, nutrition is the most important. During gestation the developing embryo depends for its nutrition on the maternal blood. Prenatal care is recognized to-day as an important factor in starting life with a good bank account of health. For some time after birth the mother gives the sustenance through the milk and the better nourished the mother is during that period the better will be the nourishment of the child. It is important to remember that during both pregnancy and lactation the mother requires more than the usual amount of nutriment and especially those foods containing the vitamins and mineral elements. Except perhaps for some deficiency in iron, as milk is

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relatively poor quantitatively in iron, the child when weaned should be in good condition. It is generally considered that the milk dietary should be supplemented with cod-liver or halibut-liver oil as a source of vitamins A and D and orange or lemon juice for vitamin C.

Where do we find the finest and healthiest specimens of mankind? Major-General McCarrison (1) claims that they may be found among the tribes of northern India among whom he lived and conducted research in nutrition. He states that not only have these people very fine physique, but many of civilization's diseases such as appendicitis, tonsilitis, cancer, etc., rarely occur. He gives as the reason, not only that they are endowed with good physique but that they live hygienic lives and use natural foods. He states: "Nutrition, as we all know, depends on a number of factors: the constitution of the food, the adequate oxygenation of the blood and tissues, the efficiency of the processes—digestion, absorption, assimilation, circulation, excretion—involved in this function, freedom from worry and excitement, general hygiene, sunlight and inherited characters." However, he places first in importance food which contains all the necessary minerals and vitamins and other essentials, giving the following list of food-stuffs: (1) a good whole cereal or mixture of whole cereal grains or a good wholemeal bread; (2) milk and the products of milk as butter, cheese, curds, etc.; (3) egg; (4) green vegetables; (5) root vegetables as potatoes, carrots, etc.; (6) legumes; (7) fruit; (8) meat; (9) water. Nutritional experiments on animals have demonstrated that these foods contain all the necessary elements for complete nutrition. It must be kept in mind, however, that such foods must be produced from soils which contain all the necessary minerals and are not lacking in such elements as iodine. Such a deficiency is found in many inland countries far removed from the sea.

Good nutrition is important all through life, but is particularly so during the earlier years of childhood and adolescence, when the brain and nervous system are developing to maturity. The growing nervous tissues are easily injured by nutritional defects and many of the neuroses of childhood can be attributed to lack of proper food. The relationship is expressed by Holt (2) as follows: "Most of the neuroses of childhood depend entirely upon disorders of nutrition. The headaches, insomnia, disturbed sleep, chorea habit-spasm, hysterical manifestations and a multitude of others are relieved only by correcting the faulty diet and habits which are the basis of the disturbed nutrition."

All the known vitamins are found in the food suggested by McCarrison. Briefly, vitamin A is necessary for the proper health of the skin, mucous secreting and absorptive surfaces in the body. When it is lacking, xerophthalmia, bronchopneumonia, enteritis, etc., may develop and growth is retarded. Vitamin B is chiefly concerned with the proper nutrition of the heart, nerves and skin, so that in its absence there ensues beri-beri, pellagra, etc. Vitamin B is considered essential in the complete oxidation of carbohydrates. It has been shown that in the brains of pigeons suffering from polyneuritis, pyruvic acid, lactic acid and glucose are not properly oxidised and accumulate in the central

nervous system, causing the acute symptoms of this disease. The necessity of vitamin B for proper functioning of the alimentary tract will be discussed later. The administration of vitamin B has been shown to be of value in reducing œdema, especially that occurring in the course of pernicious anaemia (3). Vitamin C, which is probably chiefly concerned with the nutrition of the endothelium of capillary membranes, is well known for its antiscorbutic properties. Vitamin D, in co-operation with the parathyroid glands, regulates the absorption and excretion of calcium and phosphorus, assuring the normal development of bones and teeth. Vitamin E is necessary for the healthy growth of the reproductive glands and in some animals it appears to be essential for the proper completion of the reproductive processes, preventing abortion. These are only a few of the functions of vitamins.

Mineral Elements

Research in animal nutrition has shown also the great importance of the mineral elements in the dietary. Some are present in minute amounts such as copper and manganese. The work of Hart (4) and his co-workers has shown the necessity of copper as well as iron in those pigments used for tissue respiration, such as haemoglobin and related substances. Manganese, according to Orent and McCollum (5), is in some way essential to the reproductive processes and for the formation of chlorophyll in plants.

We are apt to overlook the many uses of each mineral and the necessity for them to be kept at optimal concentration. Take, for example, calcium, which everyone remembers is necessary for the formation of bones and teeth. But calcium has many other uses which we know and there are possibly others of which we have yet to learn. Calcium is necessary at optimal concentration for the normal excitability of nervous tissue, for adequate contraction of heart muscle, for the clotting of blood and milk, and for the proper permeability of capillary endothelium. Recent works indicate that it also has a synergistic value to iron in the treatment of anaemia. In the healthy person the physiological mechanisms keep the concentration of the inorganic salts in blood and tissues at their optimal value, so long as these salts are in sufficient amount in the diet and nutrition otherwise correct.

It is often said that nature is the best guide for foods. But this is far from being true, although healthy persons on mixed diets need, as a rule, to worry little about calories and vitamins. Nature does not give to the child with rickets a love for cod-liver oil, or to the victim of scurvy an abnormal longing for oranges or lemons. It does not warn the potential diabetic against too much cane sugar.

Education in nutrition is necessary, for abundance of food of the wrong type or used in wrong proportions may really starve the body. Deficiency diseases and other nutritional disorders are found far too often at the present time. For normal children the outstanding needs are more cod-liver or halibut-liver oil during the winter months and plenty of fresh fruit and vegetables at all times.

The Alimentary Canal

Normal functioning of the alimentary system depends on proper secretion, absorption, excretion and on the movements of its muscular walls. In our bodies these are controlled by a balanced mechanism of hormones and by the autonomic nervous reflexes. Generally speaking, the sympathetic nervous system is inhibitory to the alimentary tract, putting it to rest, while the parasympathetic is motor, producing movement and opening the sphincters.

Movement is possible, however, by virtue of the ganglia in the muscular coats and the plain muscle itself has the property of independent rhythmic movement. But without the extrinsic nerves and hormones reflex co-ordination is lost, the movements being disorderly and even useless and secretory activity disturbed. These nervous reflexes and hormones keep the motile and secretory activity of the bowel in harmonious working. For example, the taste of food in the mouth produces reflexly a flow of gastric juice; when food enters the stomach, there is set up the gastro-ileal reflex causing the propulsion of the chyme from the terminal ileum into the large intestine; and the gastro-colic reflex which stimulates the onward passage of faeces in the colon. All people, however, have not been endowed with perfect physique and, of those who have, too often bad alimentary habits are formed by neglecting nature's laws with consequent alimentary penalties. Bad habits are started early. No one doubts the great advantages of our educational system, but it has its weak points. The young child, reaching school age, is torn suddenly from its natural habits to sit in school for hours in a condition of mental concentration. The child who asks leave of absence from class to attend the call of nature may be looked on as a nuisance, spoiling the discipline of the class. In this way habits of repression are formed. In civilized society generally timely attention to nature's calls are neglected, the sensitivity of the alimentary reflexes is dulled and there may be consequent abnormal dilatation of the lower alimentary tract.

Sir Arbuthnott Lane (6) claimed from his many years of experience as a gastro-intestinal surgeon that many of civilization's ills were due to intestinal stasis, partly through wrong nutrition, but also due to neglect of good alimentary habits. With better education of the public the sense of shame with which normal physiological habits are regarded will disappear. Our health authorities will insist that proper conveniences be easily accessible and that these be attractive rather than revolting as so many are at the present time.

There is no doubt that in man constipation and conditions such as haemorrhoids are due in part to sedentary habits and to the upright posture of the trunk. Especially are these conditions common in older persons when the abdominal muscles begin to lose tone. Exercise of these muscles in the horizontal position is beneficial. Another cause of intestinal stasis is our civilized dietary which not only destroys many necessary vitamins but provides so little residue after digestion that the normal stimulus for peristalsis is practically absent. The use of more green vegetables and fruits and wheat bran is helpful in supplying such essential residues. The latter contains also vitamin B which

now is thought to exert a specific stimulating action on the functions of the digestive tract.

Rest and Sleep

For normal health we need periods of rest from muscular and glandular activity and periods of sleep for refreshment of the central nervous system. In the isolated nerve-muscle preparation of the frog we find experimentally that fatigue first is present in the neuromuscular junction, the end-plate, and that sarcolatic acid has accumulated in the muscle-tissues. But in the human body it can be easily shown that the feeling of fatigue is present first in the central nervous system. This comes on long before the muscle is unable to contract by direct stimulation of its nerve and serves to protect us against injurious strain. During activity in muscles and glands, break-down processes and building-up processes go on at the same time, but the former overtakes the latter so that a period of rest for oxidation and resynthesis becomes necessary. All this can take place without sleep. Sleep means a period of recuperative rest for the cerebral cortex and, to a less extent, other parts of the central nervous system. The higher centres of the brain rest while other parts may be functioning actively. It can be shown that the skin, blood-vessels and sweat glands are more busy than normal and the alimentary tract may be functioning actively. But most functions are slowed down corresponding with the lowered metabolism of sleep. The amount of sleep necessary is roughly proportional to the metabolism, being greatest in infancy and least in old age. Tested by the response to auditory stimuli the greatest intensity of sleep is reached in the first hour or two after the commencement and becomes progressively lighter as the usual waking time is approached. Some have found a second increase of moderate intensity between the fourth and fifth hours. But there are great differences between individuals and in the same individual under different circumstances. The light sleep following the deep seems quite as necessary for complete recuperation as the more intense rest during the first hour or two. The length of sleep necessary for health differs greatly; what is quite adequate for one person may be quite insufficient for another. We find people frequently who complain that they wake too early and cannot sleep again. Such persons may have had sufficient sleep for thorough recuperation, but often they become ill both in body and mind due to worrying over their condition. I have had personal experience. For five years when serving on a sailing ship I went for three to four months at a time with sleep periods of no longer than three hours and both my shipmates and I maintained the best of health. We had no time for worry. The average sleep for twenty-four hours was seven hours.

Sleep is a function of the higher centres in the cerebral cortex and there appears to be a reciprocal relationship between this part of the brain and lower centres in the hypothalamus. When the cerebrum is sleeping the lower levels take over, that is, act as a "sleep centre". It is considered now that the hypothalamus contains the highest centres for both the sympathetic and parasympathetic nervous systems. During activity the sympathetic influences predominate, during rest sympathetic and parasympathetic are more equally bal-

anced and during sleep the parasympathetic predominates, evidenced by the lowered blood-pressure, dilatation of skin vessels, narrowed pupils, drooping eyelids, and activity of the bowel which are all parasympathetic functions. In favour of a sleep centre in the hypothalamic region is the fact that tumours and inflammatory lesions in the neighbourhood of the third ventricle bring about a sleepy state. Hess (7) injected ergotamine into the third ventricle. This drug paralyses the motor and secretory fibres of the sympathetic system, leaving the parasympathetic. The result was sleep.

The assumption of a sleep centre leads us to consider Pavlow's theory of sleep. He considered sleep a conditioned reflex. He trained animals to expect food half an hour after an auditory stimulus. The conditioned reflex of salivation took place at that time. Then he increased gradually the time interval between the conditioned stimulus and the giving of food and found that the animals tended to go to sleep in the interval, waking up at the right time and salivating. From this and other findings, Pavlow concluded that sleep was just a spread of internal inhibition over the cerebral cortex.

Sleep becomes a habit easily acquired and habits are conditioned reflexes. There seems little doubt that the routine habits at bed time, the time by the clock, the comfortable feeling of the bedclothes all suggest sleep; and many, though really tired, find great difficulty in sleeping in strange surroundings, without such conditioned stimuli, however comfortable. Although absence of stimuli through the special senses is helpful in inducing sleep, a person soon becomes habituated to the same stimuli. When such is the case, the sudden stoppage of such stimulation causes wakefulness as the sudden stopping of a clock's ticking, the cessation of throbbing movements of a steamer's engines, or the plunging into darkness of a lighted room.

There are other factors which contribute to buoyant health. The climatic stimuli, sunshine, wind, cool air and the rolling waves, operate on the skin surface and benefit metabolism. Kestner found very rapid reaction of skin capillaries in healthy children when exposed to such stimuli, but in poorly nourished children the reaction was slow until after repeated and increasing exposures. Both health and appetite also improved. The exact mode of action of such stimuli, whether on the skin, circulation, skin pigments, general circulation, liver or other organs, is not yet established.

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Puerperal Sepsis and Its Prevention*

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PART I‡

THE importance of the present high rate of maternal mortality and morbidity needs no emphasis. It has been stressed by physicians and public health officers for many years and that the mortality rate shows no tendency to fall during recent years has caused sufficient alarm to bring about several comprehensive enquiries under government or official auspices in an endeavour to ascertain the reasons.

In table I will be found a summary of the findings of four of these committees of enquiry. It will be seen that a total of 11,104 deaths in connection with child-bearing was investigated by committees in America (1, 2) and in Great Britain (3, 4). Their findings are, on the whole, mutually confirmatory and indicate that the three principal causes of death in child-birth are puerperal sepsis, puerperal toxaemias, and haemorrhage.

Definition of Puerperal Sepsis

There is no satisfactory definition for puerperal sepsis. The principal signs are an elevation in temperature with abdominal pain and a purulent discharge from the uterus. An increase in temperature over a certain agreed figure (usually 100.4°F.) is frequently employed as an indicator of the presence of puerperal sepsis for statistical and administrative purposes. A precise definition of puerperal infection is, indeed, a prime necessity for its control because the early reporting of cases should form part of the program of any public health administration so that suitable facilities for treatment and prevention of other cases can be provided. Nevertheless in several provinces of Canada the reporting of puerperal fever is not required and even in the provinces in which it must be reported the terms employed, "puerperal septicaemia" and the like, are so vague and capable of different interpretations that they are probably valueless.

INCIDENCE OF PYREXIA FOLLOWING CHILD-BIRTH

The incidence of increases in temperature during the puerperium is very variable, depending on a number of factors such as the parity of the patient and the simplicity or otherwise of the delivery. In table II will be found data for three years showing the incidence of pyrexia during the puerperium at Queen Charlotte's Hospital amongst *booked* cases (cases receiving antenatal

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‡Part II will appear in the December issue.

TABLE I

CAUSES OF DEATH IN CHILD-BIRTH

Classification	North America		Great Britain		Totals	Percentage of total cases
	New York (1)	Ontario & Manitoba (2)	England & Wales (3)	Scotland (4)		
Total deaths investigated	*2,041*	*823*	*5,775*	*2,465*	*11,104*	
Puerperal sepsis.....	510	170	1,727	608	3,015	27.1
Toxaemia (eclampsia, hyperemesis, acute yellow atrophy, etc.)	231	170	514	307	1,222	11.0
Haemorrhage (ante & post partum).....	197	76	669	219	1,161	10.4
Abortion (septic and non-septic).....	357	121	578	154	1,210	10.8
Other puerperal causes (shock, embolism, extra-uterine gestation, dystocia, etc.)	402	161	1,137	451	2,151	19.3
Extra puerperal causes (lung, heart, renal diseases).....	344	125	1,150	726	2,345	21.3

care) (5). It will be seen that 4.1 per cent. of the cases were clinically morbid, the standard adopted being that the temperature exceeded 100.4°F. on more than one occasion during any twenty-four hours following delivery excluding the first twenty-four hours.

Influence of the Type of Delivery on the Incidence of Infections

Of 533 cases admitted to the Isolation Block of Queen Charlotte's Hospital with pyrexia following child-birth, 252 (47.2 per cent.) followed "normal spontaneous delivery". Twenty-eight out of 74 (37.7 per cent.) of the deaths likewise followed normal delivery. In the same group, 246 patients were reported to have had some kind of interference during or shortly after delivery "with a death rate just below the average for the whole series" (Rivett et al, 6). It is obvious therefore that a large proportion of severe and even fatal puerperal infections follows normal spontaneous delivery and that interference during delivery does not appear to influence markedly the death rate from infection (although it is probable that it influences the incidence of infections).

Influence of the Parity of the Patient

While 80 per cent. of the admissions to the Isolation Block of Queen Charlotte's Hospital were women who had borne only one or two children, this is of very little significance in view of the modern tendency to small families.

Causes of an Increase in Temperature during the Puerperium

In table II will be found data giving, as far as it was possible to ascertain, the reason for the observed increase in temperature amongst booked cases

delivered in Queen Charlotte's Hospital in 1933, 1934 and 1935 (5). It is noteworthy that a high proportion of the cases of pyrexia was probably due to infection in another situation than the genital tract. The remainder were classified as cases of genital-tract infection. It must be stressed, however, that even with a very thorough bacteriological examination it is frequently quite impossible to assign a reason for an increase in temperature during the puerperium particularly if the increase is fleeting and of low amplitude. The majority of these cases were not carefully studied and in many instances they were undoubtedly classified as genital-tract infection for want of a more precise diagnosis.

The vast majority of the cases were never seriously ill. Indeed, as will be seen from the table, only about 25 per cent. of the morbid cases were deemed to be sufficiently seriously infected to warrant removal to the Isolation Block only a short distance away. The remainder were nursed in the general wards of the hospital.

TABLE II

MORBIDITY OF BOOKED CASES DELIVERED IN QUEEN CHARLOTTE'S HOSPITAL, 1933-1934-1935

Total booked cases delivered	7,107
Total cases morbid	296
Classification of morbid cases	
Uterine sepsis	125
Perineal and vaginal sepsis	18
Urinary infection	63
Infection of breasts	20
Influenza	21
Bronchitis	6
Tuberculosis	3
Miscellaneous	39
Total deaths (all causes)	21
(sepsis)	4
No. of cases transferred to Isolation Block	49

THE ORGANISMS CAUSING PUERPERAL INFECTIONS

It is probable that a variety of different organisms may cause the minor degrees of infection which follow child-birth. Certainly no one organism is predominant in uterine swabs taken for bacteriological examination. Haemolytic streptococci, so important a cause of the severe grades of infection, are only seldom encountered.

Cases which are sufficiently severe to warrant removal to a special hospital such as the Isolation Block of Queen Charlotte's Hospital are, however, in another category and a bacteriological diagnosis can usually be made without difficulty. In table III are given details of the clinical and bacteriological diagnosis of the first 533 cases admitted to the above hospital (Rivett et al, 6). The patients were derived from all over London and the Home Counties; they were drawn from all strata of society; only a small proportion had been delivered in Queen Charlotte's Hospital; and the only criterion for their admission was that they were febrile following labour or abortion. Only 44 of the cases were post-abortum. No less than 21 per cent. of the cases were

suffering from infection of the urinary tract without, so far as could be ascertained, any involvement of the genital tract. In addition there were a number of cases of intercurrent disease, so that fully a quarter of the cases admitted were not suffering from puerperal sepsis at all. Of those who were suffering from genital-tract infections, the largest number or 39 per cent. of the total admissions were infected by haemolytic streptococci, and 29 per cent. were infected with anaerobic streptococci. The remainder were infected by *B. coli* and other organisms. Cases which died numbered 74 and of these 51 (69 per cent.) were infected by haemolytic streptococci, 6 by anaerobic streptococci, 3 with both haemolytic and anaerobic streptococci, and the remainder were infected with organisms such as *B. coli* or staphylococci or their bacteriology was obscure.

It is thus obvious that the haemolytic streptococci are by far the most important of the organisms causing puerperal infections.

Much has been learned in recent years about both the haemolytic and the anaerobic streptococci, and as this knowledge is of importance in the study of the aetiology of infections it must necessarily be reviewed.

TABLE III

CLINICAL AND BACTERIOLOGICAL ANALYSIS OF 533 CASES ADMITTED TO THE ISOLATION BLOCK OF QUEEN CHARLOTTE'S HOSPITAL, 1930-33
from Rivett et al (6)

Clinical and bacteriological type	Number of cases	Percentage of total cases	Mortality (per cent.)
Genital-tract infection with and without invasion of other tissues			
Haemolytic streptococci	208	39	26.0
Anaerobic streptococci	157	29.4	5.0
Bacillus coli	(10)*	1.8	0.1
Staphylococci	2	0.3	100.0
Various organisms	7	1.3	14.0
Urinary tract infection without definite evidence of involvement of genital tract	113	21.1	0
Mastitis	20	3.7	0
White leg	2	0.7	0
Miliary tuberculosis	3	0.5	100
Miscellaneous cases	11	2.0	0

*This figure is necessarily tentative as the actual number is not available.

Haemolytic Streptococci

There is now abundant evidence that all the streptococci which give complete or beta haemolysis on blood agar do not form one species. By means of a relatively simple precipitin test they may be divided into at least nine groups (now known as groups A, B, C, D, E, F, G, H and K) (Lancefield, 7; Lancefield and Hare, 8; Hare, 9). Each group has a comparatively limited habitat in nature, a distinctive appearance on blood agar and characteristic

biochemical reactions. But what renders this method of classification so valuable is that it enables us to distinguish pathogenic from non-pathogenic strains, the members of most of the groups not being highly pathogenic for man or animals. The available information on this point is summarised in table IV.

TABLE IV

DISTRIBUTION AND PATHOGENIC ACTIVITIES OF THE MEMBERS OF THE DIFFERENT GROUPS OF HAEMOLYTIC STREPTOCOCCI

Group	Disease	Other sources
A	Human infections	Human nasopharynx and hands Milk of cows
B	Bovine mastitis	Human throat and vagina
C	Equine strangles and endometritis Bovine mastitis Guinea pig adenitis Human erysipelas	Human throat, vagina and skin
D	None	Human bowel and vagina Cheese
E	None	Milk of cows
F	None? Glomerulonephritis	Human throat and faeces
G	None	Human throat and vagina Monkey throat
H	None	Human throat and faeces
K	None	Human throat

Study of a large number of strains from a variety of different types of infection in human beings has shown that the great majority belong to group A. A small proportion belong to group C or group G but strains belonging to other groups hardly ever occur in infective conditions in man. The collected results of a number of workers are given in table V.

It must not be thought that haemolytic streptococci are only encountered in the diseases enumerated in table V. Impetigo contagiosa is usually due to haemolytic streptococci (Kinnear, 15; Smith and Burky, 16). A large proportion of the infections of wounds which occur in civil life and in war time are due to these organisms (Fleming and Porteous, 17; Bunce, Berlin and Lawrence, 18). Cellulitis (Ruediger, 19; Thalmann, 20), infections of the hand such as thecal whitlow, and even the apparently trivial paranychiae may also be due to these organisms. Burns are also frequently infected with haemolytic streptococci (Cruickshank, 21). Otitis media (Ruediger, 19; Wirth, 22), particularly following scarlet fever and sinusitis, may likewise be due to this organism. I am unaware that the groups to which the organisms from these infections belong have been determined but it is highly probable that they too are members of group A.

TABLE V

GROUPS TO WHICH STRAINS FROM INFECTION IN HUMAN BEINGS BELONG

Source	Disease	Number of strains examined	Group									
			A	B	C	D	E	F	G	H	K	Unclassified
Throat	Scarlet fever	117	115	—	—	—	—	—	—	—	—	2
	Tonsillitis	77	73	—	3	—	—	—	1	—	—	—
	Acute rheumatism	9	9	—	—	—	—	—	—	—	—	—
Skin	Erysipelas	28	23	—	5	—	—	—	—	—	—	—
Uterus	Puerperal fever	194	189	1	2	—	—	—	1	—	—	1
	Abortion	12	8	2	1	1	—	—	—	—	—	—
Tissues	Lymphamgitis	15	14	—	—	—	—	—	1	—	—	—
	Totals	452	431	3	11	1	0	0	3	0	0	3

This table is compiled from the results of Lancefield (7), Lancefield and Hare (8), Hare (9), Edwards (10), Plummer (11), Kodama (12), Congdon (13), and Otero and Lebrun (14).

It is thus obvious that haemolytic streptococci occur in an extremely diverse set of pathological conditions in human beings; further, that the vast majority belong to the serological group A; and that organisms belonging to this group, wherever they may be found, must be looked upon as potentially pathogenic for man. A small proportion of the infections may be due to organisms belonging to groups C and G but the members of the remaining groups are not usually found in human infections.*

Subdivision into groups is a broad method of classification and probably denotes species differentiation. The members of most of the groups may be further subdivided by means of agglutination, precipitation or biochemical methods into a number of different types. Amongst strains belonging to group A, for instance, there are at least 23 different types distinguishable by agglutination (Griffith, 24).

D. Colebrook (25) has shown that of 125 strains from cases of puerperal fever 85 could be placed into one or other of the types which make up group A. The remaining strains, although known to be members of group A, could not be placed into any of the known types. It is also of considerable interest and importance that no fewer than 30 of the 125 strains fell into types 1, 2, 3, or 4, into which types the majority of strains from scarlet fever can also be placed (Allison, 26). There is thus no evidence that puerperal strains are serologically different from strains isolated from other types of infection.

Anaerobic Streptococci

That the anaerobic streptococci are responsible for many cases of puerperal infections is suggested by the fact that in a high proportion of cases there is a bacteriaemia with an associated thrombophlebitis and that the organisms can be isolated not only from the genital tract but also from secondary foci

A possible exception to this statement is group F. The members of this group occur with considerable rarity in infections of the respiratory tract (Lancefield and Hare, 8) and Long, Bliss and Walcott (23) have brought forward evidence suggesting that they occur with unusual frequency in the throat in cases of glomerulonephritis.

such as peritonitis and matastatic abscesses (Schwartz and Dieckman, 28; Schottmüller, 27; Colebrook, 29; and Harris and Brown, 30).

They are quite unlike the haemolytic streptococci both in the formation of their colonies and in that they give neither alpha nor beta haemolysis on blood agar. They are very particular as to the media on which they will grow and are strict anaerobes, being actually killed by exposure to the air within a few hours.

Their taxonomy is more unsatisfactory than that of any of the streptococci, for which reason Colebrook and Hare (31), working with strains derived entirely from the genital tract, ignored previous attempts at nomenclature (Prevot, 32) and called the two main varieties they isolated from the genital tract type A and type B.

Type A is characterised chiefly by its ability to form gas with an unpleasant smell in media containing serum or cooked meat. Its colonies tend to be opaque yellowish-white in colour, their contour is umbonated and they have an entire edge. The colonies are from 1.5 to 2.5 mm. in diameter. It probably corresponds to *Micrococcus foetidus* of Veillon (33) or *S. putrificus* of Schottmüller (34).

Type B does not form gas and its colonies are transparent domes 1 to 2 mm. in diameter. It probably corresponds to *S. anaerobius micros* of Lewkowicz (35). (Two other varieties designated types C and D were also described by Colebrook and Hare but they occur only infrequently.)

There is evidence that the two main varieties are serologically distinct and attempts to bring about mutation from one to the other have so far failed. Nevertheless both varieties frequently make their appearance together in foci of infection or in the associated bacteriaemia. They occur with approximately equal frequency (Harris and Brown, 30).

B. coli

The coliform bacilli which cause infections of the uterus and genital tract have no special characteristics and are identical with those of the faeces (Smith, 36).

Other Organisms

B. welchii, staphylococci and pneumococci may occasionally cause puerperal infections. They do not require special comment.

SOURCE OF THE INFECTING ORGANISMS

Because it is probable that the source of each species of organism which can cause puerperal infection is different, it is necessary to discuss each separately.

Haemolytic Streptococci

Haemolytic streptococci are of very wide distribution in nature since they occur in a variety of comparatively common infections already enumer-

ated but they are also present in from 10 to 30 per cent. of normal throats, in 2 to 3 per cent. of vaginae before delivery, occasionally in the faeces, and on the skin of the hands, while they occur with comparative frequency in the raw milk of cows. Because of this wide distribution, control of infection has in the past been well-nigh impossible.

The observation that haemolytic streptococci do not form one species but can be split into groups of which only one need be looked upon with apprehension by human beings, and the further observation that a great many saprophytic strains do not belong to this group has, however, given us a very powerful weapon for the control of infection. We have in consequence much more information than was formerly at our disposal as to the possible sources whence the infecting organisms might have been derived.

A fairly complete survey has now been carried out on both the incidence of haemolytic streptococci in human beings and their surroundings and the groups to which the strains belong. The results of these investigations are given in table VI.

TABLE VI

DISTRIBUTION OF GROUPS AMONGST HAEMOLYTIC STREPTOCOCCI IN ABSENCE OF DISEASE

Source	Frequency of presence of haemolytic streptococci	No. of strains studied	A	B	C	D	E	F	G	H	K	Unclassified	Author
Atmosphere													
Normal air	0												Williams (37)
Near cases	100%	27	27	0	0	0	0	0	0	0	0	—	White (38)
Human Beings													
Normal nasopharynx	20%	150	63	5	15	0	0	12	13	25	8	9	Hare (9)
Normal faeces	29%	32	0	0	0	13	0	5	2	8	0	4	Hare and Maxted (39)
Vagina before delivery	1.5%	12	0	6	1	0	0	0	5	0	0	0	Lancefield and Hare (7)
after delivery (no fever)	7.8%	66	1	26	5	26	0	2	3	0	0	0	Lancefield and Hare (7)
Skin of hands	9.9%	18	7	0	1	0	0	1	1	3	0	5	Colebrook, Maxted and Johns (40)
of back	14.2%	2	0	0	1	0	0	0	0	0	0	1	"
of peri-anal region	6.8%	11	0	0	1	10	0	0	0	0	0	0	"
Animals													
Milk of cows	26.6%	Not yet studied but group B commonest. Group A very rare.											Frost, Gumm & Thomas (41)

From this it is clear that haemolytic streptococci of the potentially pathogenic group A do not occur in the atmosphere generally, in the faeces of pregnant women, on the skin of the back or peri-anal region and, most important of all in the present connection, in the vagina before delivery. They do occur with some frequency in the atmosphere in the neighbourhood of infected cases, in the nasopharynx of about 7 per cent. of apparently normal persons, on the skin of the hands of about 3 per cent. of normal persons, and

very rarely in the milk of cows. It is also probable, although this point has not yet been investigated, that they occur on the handkerchiefs and in the pockets of those who harbour them in the nasopharynx. To this list must be added the extremely diverse set of pathological conditions such as scarlet fever, tonsillitis, erysipelas, impetigo, infected wounds, and other conditions already enumerated (table V).

Thus in puerperal infections the organisms were probably not derived from the vagina or faeces of the patient but may have been derived from other cases of infection by direct transfer or by way of the atmosphere; from the nasopharynx of attendant or patient; or from the hands of attendant or patient. These are the only known possible sources.

Kanter and Pilot (42) first suggested that the nasopharynx was the probable source of infection but Smith (36, 43) was the first to show that if swabs be taken from the throats of the personnel who attended the delivery of a woman who subsequently became infected, one or other was almost always heavily infected with haemolytic streptococci and that such carrier strains were usually identical with the strains causing the infection when compared by the method of agglutinin absorption. His work has been amply confirmed and to some extent extended by other workers. Their results are summarised in table VII. D. Colebrook (25) has also shown that in 20 per cent. of her cases, the contact from whom the organisms were probably derived was known to have had an inflammatory condition of the nose or throat before attending the confinement. In 20 per cent. a strain identical with that causing the infection was found in the nasopharynx of a member of the mother's family. And the organisms were isolated from the nose of the carrier who was probably the source of the infection as often as from the throat.

TABLE VII

PROPORTION OF HAEMOLYTIC STREPTOCOCCAL PUERPERAL INFECTION TRACEABLE TO SOME EXOGENOUS SOURCE OF HAEMOLYTIC STREPTOCOCCI

	Smith (36) (43)	Paine (44) (45)	Courmont & Sedallian (46)	D. Colebrook (25)
Number of cases investigated.....	49	7	6	48
Number of cases with haemolytic streptococci of serological identity in upper respiratory tract of attendant at delivery.....	30	5	6	24
ditto in patient	8	1	0	6
ditto in septic focus somewhere in neighbourhood	2	0	0	9
Source undetermined.....	9	1	0	9

Other evidence may also be cited. Paine (45) has shown that there is a marked seasonal variation both in the percentage of the population who carry haemolytic streptococci in the nasopharynx and in the number of haemolytic streptococcal puerperal infections. The curves follow each other closely, that for the puerperal infections a little behind that for the incidence in the throats.

The maximum is reached, in both instances, in March or April and is lowest in the third quarter of the year. In Boston, Mass., Williams (47) has also shown that the curve of the incidence of puerperal infections follows closely that of respiratory tract infections.

There is thus ample evidence that haemolytic streptococcal infections in the puerperium are not endogenous, but are derived from an extragenital source of which the most important is the nasopharynx of one or other of the attendants.

Anaerobic Streptococci

The only situation in nature in which anaerobic streptococci are known to occur with any frequency is the vagina (Kronig, 48; Natvig, 49); White (50) actually found them in the vagina of 50 per cent. of women examined shortly before delivery. It is therefore probable that in infections the organisms were derived from those present in the vagina. Additional evidence in favour of this view is afforded by the observation that of 19 cases with bacteriaemia, no fewer than 15 had had some form of interference during delivery. (The remaining four cases were abortions, of which two were probably self-induced) (Rivett et al, 6). Further, epidemic spread of the infection to other cases, such as one would expect to occur occasionally if carriers were the usual source, has not yet been observed.

B. coli

It is probable that the organisms are derived from the faeces (Smith, 36).

ELEVENTH ANNUAL CHRISTMAS SEAL SALE
CANADIAN TUBERCULOSIS ASSOCIATION

WITH the eleventh annual Christmas-seal campaign now in progress the Canadian Tuberculosis Association is again calling the attention of the public to the fact that the money raised is devoted to the prevention of tuberculosis. More than sixty-five million seals have been printed by the Association and distributed to the sixty-five committees across Canada. These committees prepare their own program and conduct the campaign locally with commendable zeal and excellent results, the Canadian Tuberculosis Association arranging for supplies, field service and organization.

That Christmas-seal funds finance a great diversity of preventive measures such as clinics, public health nurses, travelling consultants and school surveys, is due to the fact that funds are spent locally under the direction of local committees which of course are best able to judge the needs of their own community.

So far-reaching is its appeal that the Christmas seal has become an annual institution, recognized by rich and poor alike as a tangible way in which they may take part in a worthy cause. All are invited to share in this Canada-wide effort.

"Buy Christmas Seals—Prevent Tuberculosis."

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ZINC-SULPHATE NASAL SPRAY IN THE PROPHYLAXIS OF POLIOMYELITIS

THE Department of Health of Ontario is to be heartily commended for making possible the study of the zinc-sulphate nasal spray which was suggested by the promising results of Schultz and Gebhardt in their observations in monkeys. Their results marked an advance in the effort that has been made during the past two years to effect protection in monkeys by applying solutions of various chemicals to the olfactory area in the upper nasal tract. Clinical trial of the laboratory findings was quickly made. Last year in the United States and in Manitoba extensive trial was made of a picric acid—alum solution. Although it is estimated that two million people received the spray in Alabama, Tennessee and Mississippi, it has been impossible to determine the value of the spraying because of the unsatisfactory manner in which it was conducted.

Knowing that little information of value would be obtained in Ontario if the zinc-sulphate nasal spray was used in an uncontrolled manner and that, to permit of conclusions being drawn as to its value, controlled observations were essential, the Department of Health of Ontario endorsed a plan for a trial, under proper conditions, of a group of approximately 5,000 children. The Department pointed out to municipalities throughout the Province that until specific information was obtained, no advice concerning the employment of nasal spraying could be offered by the Department. This action prevented an epidemic of spraying, since extensive publicity had been given by the press to the recently published results of the expxeriments in monkeys and to the technique for human nasal spraying.

The findings of the study are presented in this issue of the Journal. It is unnecessary to comment on the care with which the study was made. The authors have made conclusions that appear to be fully warranted from the findings. These findings, however, should not be interpreted as discrediting the efforts to prevent poliomyelitis by the introduction of chemicals or other sub-

stances into the nasal tract. The results relate only to the use of zinc sulphate as applied according to the technique followed. Other methods of applying this or other chemicals may result in different findings. It is important to remember that in this study the spraying was not repeated on three successive days as was recommended by the original investigators, since it was considered that such repeating of the spray would not be feasible. To be of practical public-health value, it was believed that a single spray, repeated at intervals of 10-12 days, would be all that was possible. The authors conclude that nasal spraying even to the extent employed in this study cannot be considered a practical public-health procedure. The study, therefore, is of value not only in supplying the information concerning the spraying with zinc sulphate but also in indicating the limitations of the procedure from the public-health standpoint.

It may well be said that the group studied was too small. The fact remains, however, that cases of poliomyelitis did occur among children who had been sprayed by otolaryngologists with every facility for the proper conduct of the spraying. The size of the group permitted careful work. It is true that the results would have been more complete if the spraying could have been undertaken at an earlier date, thus permitting a longer period of observation of the treated children, but it is doubtful if the spraying could have been commenced earlier since the response of the public to the offer of the trial was dependent on their appreciation of the seriousness of the epidemic as reflected in the number of reported cases. The first spraying was actually completed during the week in which the peak of the incidence occurred and the incidence continued at a high rate for several weeks.

Much work remains to be done before an answer can be given as to the possibility of affording protection by nasal spraying with various chemicals or other solutions. The procedure, of course, is based on the assumption that the virus enters through the olfactory area. If the portal of entry be the olfactory area, is the loss of sense of smell an indication that this path has been blocked by the chemicals used? If this is so, the results of this trial, in which the zinc-sulphate nasal spray was administered on two occasions with an interval of 10-12 days between the spraying, would indicate that the procedure was not successful in all since not more than 25 per cent. of the children tested had anosmia.

In few cities has there been such whole-hearted co-operation on the part of the administrative authorities, the public, and the press in an undertaking which was definitely presented as an experiment. To this extent the study was unique. The advancement of our knowledge of possible means of protection against disease can be obtained only by carefully controlled observations made under proper auspices. This study is evidence that such observations can be made.

CURRENT PUBLIC HEALTH COMMENT

MALNUTRITION

A GROWING interest is being manifested in the influence of diet upon the health and welfare of the race. This interest gained considerable impetus from the findings in respect to physical fitness noted during the war years and also during more recent efforts to enlarge the trained force of fighting men in Great Britain and elsewhere. Extensive investigations have been made latterly of the present status of the physical well-being of society in general and in this work the League of Nations has played a prominent part, particularly since 1930. From time to time, too, reports and papers have expressed the opinion that a large proportion of the population is physically unfit, largely due to inadequate or defective diet. The economic unrest which made thousands of families dependent upon relief diets has also provided greater opportunity and need for a thoughtful and scientific consideration of the problem of diet and health.

In 1935 there was published a rather critical book under the title "Public Ill-health", in which the author, C. E. McNally, Honorary Treasurer of the Committee Against Malnutrition in England, challenged the conclusions arrived at in the official English report on public health. He takes exception to the attitude, which he terms "complacent", toward certain problems which he believes to be of signal importance, particularly the rather unfortunate condition of those who live in the poorer districts. Regardless of whether or not we agree fully with the author, one cannot dispose of the statement that malnutrition is greater to-day than it has ever been, except by scientific investigation. Indeed, there is some evidence available that the economic depression, though not immediately reflecting its effects upon the public health, has produced some very undesirable consequences. For instance, in the July issue of this Journal, it was pointed out by Dr. George F. Buchan that the first report of the Advisory Committee on Nutrition, which was appointed in 1935, has recently been made available. This report includes the statement that "a small fraction of the population are not obtaining the full amount of calories they require, nor their full quota of fat, and that there is probably some shortage of animal protein in the diets of the poorest section of the community." The Committee further urged an increased consumption of milk and record their view that from the health standpoint "there is no other single measure that would do more to improve the health development and resistance to disease of the rising generation than a largely increased consumption of safe milk, especially by *mothers*, children, and adolescents."

In reviewing the situation it becomes evident that the most important need at the moment in this field is a simple reliable method of assessing the state of nutrition. The report of the Committee of Experts on this subject, appointed by the League of Nations Health Organization, led one to infer that there was no answer to this need at the moment. Nor has the English Advisory Committee on Nutrition been able so far to recommend any such satisfactory method. A great step forward will have been made when this need is satisfied.

Adequate diet is of particular importance among pregnant women, both in so far as the health of the mother is concerned and, as well, that of the off-spring. Despite the tremendous volume of effort which has been spent on investigations of maternal mortality, the only worth while conclusion which has been

reached is that improvement in obstetric service is the measure of major importance and the one most likely to bring about a reduction in this death toll. The influence of diet as a factor in maternal mortality has until recently not received a great deal of consideration. In October 1936, however, there appeared in "Public Health" an article on "Malnutrition as a Cause of Maternal Mortality" by Lady Williams, Honorary Secretary of the Joint Committee on Midwifery. In this paper and in subsequent reports, the nature of an experiment conducted in the Rhondda Urban District, Glamorgan, was described. The object of this experiment was to discover "whether by intensive efforts in any given year in areas where high puerperal death rates had prevailed for some years, a reduction in the number of maternal deaths could be brought about; secondly, whether any clue could be obtained from such an experiment as to which of many possible improvements in the maternity services of these areas was the most urgently required." This scheme was carried out jointly by the local authority and the National Birthday Trust Fund and was confined to the Rhondda area including a population of about 140,000, an area particularly suitable for such an experiment on account of the serious unemployment prevailing.

An increase in the facilities for ante-natal examination, the provision of an obstetrical specialist for both consultation at the ante-natal clinics and in the home, the organization of refresher courses for about half the practising midwives, and other benefits failed, however, to influence the recorded puerperal death rate which reached a peak of 11.3 per thousand births in 1934. (The average rate for the previous six years was 7.2.) During this preliminary period it was found that there was considerable evidence of malnutrition, though at the outset "no idea was entertained that the high puerperal mortality was related to malnutrition." Hence, during 1935, a supply of foodstuffs was distributed from the clinics at the discretion of the medical officers in charge. A marked reduction in the puerperal death rate is reported to have followed immediately upon the introduction of this routine, appearing to substantiate the success of the supplementary feeding experiment.

In order to determine whether the beneficial results achieved were due to the improved diet alone or to improved medical and midwifery facilities, the feeding scheme alone was extended to 5 adjoining towns of a similar type. Preliminary figures for the first six months of 1936 seemed to indicate that the improvement in the mortality rate was "due to" the improvement in nutrition of the expectant mothers rather than to any other cause. Indeed, the official figures in the full year 1936 yielded a puerperal death rate in the Rhondda area of 5.1 per 1,000 births compared with 7.2 for the 8 years 1927-34, while in the 5 new areas the rate for 1936 was 2.6 compared with 6.6 for the 8 years 1927-34.

Further discussion in the first paper on this subject presented some statistical evidence of a different sort indicating malnutrition as a cause of maternal mortality. Comparisons were made for different centres of the trend in the maternal and infant death rates. Here, it was demonstrated that there was no coincidence between the infant and maternal rates (with stated exceptions). However, there did appear to be a correlation between the two rates when the infant rates were charted for the year preceding each maternal rate. The author attributes this remarkable finding to the improved nutrition of the mothers under certain circumstances in certain areas and years so that the babies already born received more adequate food during that year and benefited first while the pregnant mothers of that year showed the good effect of extra food on their health in the following year with a lower maternal death rate.

The author's conclusion that "the failure of the medical scheme carried out in the Rhondda Valley during 1934 seemed to suggest that the answer to the problem of how to reduce the maternal death rate *of all districts* [italics ours] to the level of the best area, must be looked for in some other direction than in the mere improvement and extension of medical facilities of whatever sort" seems to us rather unsound. Numerous investigations and several actual experiments have shown what can be done by improvement in medical and nursing care alone. Recent publications dealing with the Rochdale experiment and the work in the Borough of Willesden have established the fact that improvement in these channels "alone" brings apparently signal success.

Not only that but, regardless of what may be said about no change being introduced along with the feeding scheme in the five new areas, it is difficult to imagine that there was no improvement in the midwifery service, such as undoubtedly would result from increased interest and publicity in the areas concerned. Indeed, such improvement undoubtedly contributed materially to the successful reduction of the death rate in the Rhondda area in 1936, when the improved obstetrical service already initiated was supplemented by a feeding scheme. To establish diet as the sole or even as the major factor in the success of this experiment is a task which undoubtedly will require years of careful research and study. Not only must one be certain that no other variable than diet is being introduced under the feeding scheme but careful precaution must be taken that the samples of women under observation are the same or comparable in all basic respects as age, parity, etc. Rates for one or even two years are of doubtful value, too, because of the known fluctuation in local rates, sometimes rather violent and apparently due to chance alone, observed in Canadian experience and elsewhere.

It is rather noteworthy that the decline in mortality observed did not influence equally the death rate from sepsis and "other causes." This may, however, be attributable to other causes than the feeding alone. Furthermore, a strict statistical comparison has not been made in the figures so far presented, the groups of women not being strictly comparable. If the more logical comparisons are made, however, the figures are inadequate to sustain the hypothesis presented. For instance, if we compare the experience of the five areas in Glamorgan under the food scheme (plus dressings) with the unassisted groups in the same areas, we find the rates to be 1.66 and 3.98 respectively. The standard deviation for these two rates are 0.96 and 1.92. The difference, 2.32 ± 2.19, is certainly not significant.

In the most recent report on this work, which appeared in April last, it was indicated that the Medical Research Council has given advice and assistance in drafting a revised scheme. The further work will deserve our careful attention. Regardless of what has been said herein, the very fact that the work undertaken by the National Birthday Trust Fund has attracted greater interest in the importance of adequate diet in pregnancy, marks it as an extremely valuable piece of work.—*A. Hardisty Sellers, B.A., M.D., D.P.H.*

PLANS, PROGRAMS, AND PROGRESS

Sixty-sixth Annual Meeting, American Public Health Association

THE sixty-sixth annual meeting of the American Public Health Association, held in New York October 5th to 8th, had the largest registration of any meeting in the Association's history. Preceding the meeting the sixth health education institute was held. The success of this type of presentation has given encouragement to the suggestion that the health officers should convene a similar institute dealing with health administration. In view of the large number of sections of the Association, each having a series of programs and requiring large rooms for their accommodation, the sessions were held in the hotels Pennsylvania, New Yorker, and McAlpin. Two meetings to which the public was invited were held in the Manhattan Opera House. The technical and scientific exhibits, which were located in the Hotel Pennsylvania, were not only extensive but also of a high order of excellence.

Among the special sessions was one devoted to "newer responsibilities in public health administration." At this session the Hon. Josephine Roche, Assistant Secretary of the Treasury (in charge of the Public Health Service), discussed the problem of medical care as a public-health function. The control of syphilis, cancer, and diabetes was also presented by well-known leaders. Miss Roche pointed out that three out of every four deaths in the United States are caused by the chronic diseases and that two of every three deaths from these causes occur among those of the low-income group who cannot afford to pay for adequate medical care. The death rate of between forty and fifty million Americans with incomes of less than $1000 a year, from the ten major diseases that cause three out of every four deaths in the United States, is twice that of the rest of the population. These facts were revealed for the first time in a Federal survey of 750,000 American families (3,500,000 persons). For seven of the ten diseases the death rates mount as the income goes down. The seven include heart disease, cancer, pneumonia and influenza, kidney disease, tuberculosis, diarrhoea and enteritis, and syphilis. Miss Roche urged that the Association formally recognize the problem of the present uneven distribution of medical services and the widespread human needs of today. The Governing Council gave careful consideration to this matter and recommended that a special committee be appointed to devise means by which organized medicine and Federal agencies would co-operate to extend public health work to meet modern needs. The special committee would study the public health aspects of medical care and co-operate with the United States Public Health Service and other Federal agencies, the American Medical Association, the American Dental Association, and other appropriate bodies. This action is significant in view of the present discussions of the provision of medical care and the relationship between the private physician, the public, and the State.

A second special session was devoted to the hygiene of housing. The topics of housing and health, heating and ventilation, lighting, economics of insulation, plumbing, safety, etc., were presented in a program arranged by Professor C.-E. A. Winslow. The large attendance at this session indicated the wide interest of the members in housing problems.

A feature of the meeting was the "pioneers' luncheon", presented by the Public Health Association of New York City, depicting in dramatic form the work of the early health pioneers in New York, including Dr. Stephen Smith, Dr. Edward Trudeau, Dr.

Hermann M. Biggs, Dr. William H. Park, and Miss Mary Brewster and Miss Lillian Wald who established the first visiting-nurse service on Henry Street. The presentation was made even more interesting by Dr. Haven Emerson, who, as narrator, introduced each episode.

In addition to the resolution relating to medical services, other important resolutions were passed. One strongly supported the passage by Congress of the Vinson Bill to stop stream pollution. Another urged again that the administration of public health be removed from political interference and that the selection of public health personnel should be based solely upon professional qualifications. A strongly worded resolution related to maternal care, calling not only for further provisions but also for more satisfactory instruction of undergraduate nurses and medical students as well as the provision of post-graduate facilities. Appreciation of the work of Mr. Evart G. Routzahn was expressed in another resolution. Mr. Routzahn, at the time of the last annual meeting in New York in 1921, led in the movement to establish public health education and since that time has continued his efforts in this field of public health service, including the editing of the department of health education in the American Journal of Public Health.

Dr. Abel Wolman, Professor of Sanitary Engineering at Johns Hopkins University, was chosen President-elect of the Association. He will take office at the annual meeting next year, which will be held in Kansas City. Other officers elected were: Dr. John L. Rice, Health Commissioner of New York City, 1st vice-president; Dr. J. T. Phair, Chief Medical Officer of Health of Ontario, 2nd vice-president; Dr. Domingo Ramos, Director of Health of Havana, 3rd vice-president; Dr. Louis I. Dublin of the Metropolitan Life Insurance Company, treasurer; and Dr. Reginald M. Atwater, executive secretary. Dr. Grant Fleming, Montreal, and Dr. J. T. Phair, Toronto, were elected to the Governing Council.

The meeting was attended by a large group of Canadians. Seven Canadian Provinces were represented and Dr. R. E. Wodehouse, Deputy Minister of Pensions and National Health, brought the greetings of Canada. Dr. Wodehouse also participated in the special broadcasts made during the meeting, speaking on the subject of "International Co-operation in Health Work" over Station WHN, New York.

ANTI-DIPHTHERIA CAMPAIGN IN THE CITY OF QUEBEC

UNDER the leadership of Dr. Valmont Martin, Director of the Municipal Health Bureau, a campaign is being conducted for the administration of diphtheria toxoid to all children in Quebec City. Since January, 1937, 55 deaths have occurred and 458 cases were reported to November 14th. More than 7,000 children are receiving the preventive treatment. Immunization clinics are being conducted and diphtheria toxoid is being supplied without charge to physicians, and a door-to-door distribution of small posters has been undertaken. During October approximately 800 children received the preventive treatment. An initial vote of $2000 was made for the conduct of the campaign.

POLIOMYELITIS AFTER-CARE IN ONTARIO

AS PART of the effective program conducted by the Department of Health of Ontario in meeting the emergency of the poliomyelitis outbreak, provision has been made for proper after-care for all children with evidence of paralysis. Reports have been received regarding all cases and the Department has provided three weeks' hospitalization without charge for all cases that require treatment on a Bradford frame or other orthopaedic care. In Toronto the former Grace Hospital was opened

on September 29th under the supervision of Dr. D. E. Robertson, Chief Surgeon of the Hospital for Sick Children, to accommodate cases in the Toronto area. Similar provision has been made in Hamilton, Windsor, London, Ottawa, Kingston, and Sudbury. The splints most frequently needed have been supplied by the Hospital for Sick Children in enough different sizes to fit any child and of a type that can be provided without any complicated measurements. The profession throughout Ontario was advised by the Department concerning these provisions. It is believed that as a result of the steps taken, the occurrence of serious crippling will be minimized and deformities greatly reduced.

PHYSICIANS ENROLLED AT THE SCHOOL OF HYGIENE, UNIVERSITY OF TORONTO

THE FOLLOWING physicians are enrolled for the course leading to the Diploma in Public Health at the School of Hygiene, University of Toronto, during the academic session 1937-38: Dr. J. L. M. Anderson, Victoria, B.C.; Dr. J. P. Beaudet, Three Rivers, Que.; Dr. U. T. Byrne, Essondale, B.C.; Dr. A. A. Dalcourt, Louiseville, Que.; Dr. E. L. Davey, Toronto; Dr. Albert Dumas, Mont Laurier, Que.; Dr. T. A. LaSaine, Nashville, Tenn.; Dr. P. E. Moore, Hodgson, Man.; Dr. R. S. Peat, Athens, Ont.; Dr. P. P. Pion, Ste. Clothilde de Horton, Que.; Dr. J. S. Robertson, Sydney, N.S.; Dr. W. B. Stiver, London, England; Dr. E. H. Struthers, Tsinan, Shantung, China; Dr. Agnes M. Swan, Winnipeg, Man.; Dr. J. A. Taylor, Cranbrook, B.C.; Dr. R. A. Walton, Stony Plain, Alta.; Dr. F. B. Wishart, Sydney, N.S.; and Dr. C. H. Yen, Fukien, China.

APPOINTMENTS

DR. G. M. LITTLE, D.P.H., has been appointed Medical Officer of Health for the City of Edmonton, succeeding Dr. R. B. Jenkins, D.P.H., who has assumed his new duties as Chief of the Division of Epidemiology in the Department of Pensions and National Health, Ottawa. Dr. Little was formerly Medical Officer of the Red Deer Full-Time Health District with headquarters at Red Deer, Alberta.

DEATHS

IN THE PASSING in August of Dr. Andrew Jerome Harrington, the Canadian Public Health Association lost another member of the group of original incorporators of the Associaiton. It will be recalled that Dr. Harrington, Dr. C. J. C. O. Hastings, Mr. T. Aird Murray, C.E., Dr. Duncan Anderson, and Dr. L. M. Coulter made applications for the incorporation of the Association in Ontario in 1910 and that a Dominion charter was granted in 1912. A close friend of every movement designed for the improvement of public health, Dr. Harrington, although engaged in private practice, supported in every way the Association in its early days. Throughout his many years of practice he continued his interest in medical and social problems, taking a particular interest in the later years in the efforts to provide adequate medical, dental, and nursing services throughout the country.

DR. E. D. CARDER, a senior member of the Department of Health of Vancouver, died suddenly at his home in Vancouver on November first. Dr. Carder had served as part-time specialist in communicable diseases from 1914 until his appointment recently as epidemiologist. During the many years in which he was a member of the Department of Health, Dr. Carder established a reputation as an expert clinician and diagnostician. In the field of epidemiology, he published papers embodying investigations of smallpox and other diseases which were read with great interest. In his passing the profession and the Department have suffered a deep loss.

ASSOCIATION NEWS

Christmas Meeting of the Laboratory Section

THE committee in charge of the program for the sixth annual Christmas meeting of the Laboratory Section, which will be held in the Royal York Hotel, Toronto, December 20th to 22nd, has pleasure in announcing that Dr. Thomas Fancis, Jr., of the Laboratories of the International Health Division of the Rockefeller Foundation, New York, will be the guest speaker. Dr. Francis, whose studies of influenza virus are so well known, will present some aspects of his researches in this field and will speak on Tuesday afternoon, December 21st.

The committee is very pleased also that Dr. William Boyd, Professor of Pathology and Bacteriology, University of Toronto, will be the speaker at the luncheon on Tuesday. Dr. Boyd is well known as the author of several important text books in pathology and prior to his appointment in the University of Toronto last July occupied the Chair of Pathology in the University of Manitoba.

On Monday evening an informal dinner will be followed by a discussion of laboratory methods in the diagnosis of enteric infections. Many members have contributions to make to this subject and the committee believes that a live discussion will follow the introduction of the subject by the three speakers selected.

The demonstrations on Wednesday morning will be of special interest. They are being arranged in the Department of Health Laboratories, Parliament Buildings; in the laboratories of the Department of Public Health, City of Toronto; in the Department of Bacteriology and Pathology, Banting Institute; and in the Connaught Laboratories, University of Toronto.

Contributors to the program are reminded that the titles of papers must be submitted not later than December 4th. The field of the meeting covers bacteriology, pathology, immunology, and chemistry in relation to hygiene. Papers are limited to fifteen minutes, and abstracts should be submitted not later than December 4th so that they may be printed for distribution at the meeting. The abstracts will also be reprinted in the January issue of the JOURNAL.

Certification of Sanitary Inspectors

THE Central Board of Registration and Examination of the Committee on the Certification of Sanitary Inspectors has reported the results of the third annual examinations which were held on September 22nd, 23rd and 24th in five provincial centres: Vancouver, Edmonton, Regina, Manitoba, and Toronto. Forty-six candidates sat for the examinations. The following passed or were conditioned in one subject:

British Columbia: William M. Black, Arthur B. Cockle, Joseph Fuller, Alexander A. Gracey, Samuel C. Kinniston, John D. Lee, Norman E. Pengelly (*Communicable Diseases*), John E. W. Proud, and Laurence E. Robertson. Alfred Holmes was granted standing in the field investigation report and the oral examination.

Alberta: William C. Batty and Edgar E. C. Powell.

Saskatchewan: Oliver S. Fyfe and William C. N. Reed.

Manitoba: Louis J. Hunter, Cyril G. Muller, Lorne Slaght, Wilfred Taylor, and Conrad E. van Engel.

Ontario: Albert Clarey, Robert A. Colling, Albert E. Cooke, Thomas P. Cox (*Field Investigation Report*), Harry Dennison, George L. Downes, George H. Edwards, Louis S. Fox, Harry R. Gibbon, George A. Gompf, John M. Homer, T. Lloyd Jones, John L. Kennedy (*Sanitation*), Arthur H. Lomax, Donald McDonald, John

P. Mardall, John O'Hanley (*Sanitation*), Ernest J. Picton, Aubrey C. Shain, Arthur L. Smith (*Sanitation*), and Arthur Widdup. Arthur W. Brett was granted standing in the field investigation report and the oral examination.

Candidates who are conditioned in one subject are permitted to rewrite the paper and to repeat the oral examination at the next annual examination. They must complete the work before the certificate is granted.

The examination papers in the three subjects, *Sanitation*, *Food Control and Legislation*, and *Prevention and Control of Communicable Diseases* were as follows:

SANITATION

Time: 3 hours

1. (*a*) What are the essentials of a satisfactory and safe drinking water?

(*b*) A town of 2,000, situated on a river which is turbid and subject to pollution, desires to instal a municipal water works, utilizing the river for supply. (i) Outline the constituent parts of such a system. (ii) Describe the method of treatment which might be used to render this water satisfactory and safe.

2. (*a*) What do you understand by the chemical examination of water?

(*b*) Give in detail the method for properly taking a sample of water for bacteriological examination.

(*c*) A laboratory report of a sample of a well water indicates the presence of *B. coli* in 1 cc. Discuss the significance of this report.

3. A rural school of four rooms is to be constructed. Give in detail your recommendations concerning the proper provision for:

(*a*) Water supply.
(*b*) Sanitary toilets.
(*c*) Satisfactory ventilation.
(*d*) Proper lighting, both window and artificial, with due consideration to the location of the blackboards.

4. (*a*) In sequence describe the parts of the sewage drain system from the roof to the trunk sewer.

(*b*) Explain the following terms:
(1) Storm sewer.
(2) Cross-connection.
(3) Activated sludge treatment.

5. Discuss the various factors that should be considered in providing for disposal of refuse in dumps. Outline the care that should be given to such a dump.

FOOD CONTROL AND LEGISLATION

Time: 3 hours

1. (*a*) Enumerate five diseases which may be transmitted to man by milk and indicate the source of the infection in each instance.

(*b*) Describe in detail the various steps in the handling of milk in a dairy conducting pasteurization, from the receiving of the milk to the delivery from the plant. Indicate clearly your duties as an inspector in each part of the process.

2. Discuss meat inspection under the following headings:

(*a*) Reasons for inspection.
(*b*) Conditions calling for condemnation of part or whole of carcass.
(*c*) Federal and municipal responsibilities.

3. Describe the procedure which you would follow in making an inspection of a restaurant seating fifty persons. Outline the form of your report, grouping your findings under suitable headings.

4. (*a*) What legislation deals with the adulteration or misbranding of food products?

(*b*) How is control exercised by the governmental and municipal departments concerned?

5. Write notes on:

(*a*) Washing and sterilization of dairy-farm utensils.
(*b*) The Babcock test for butter-fat in milk.
(*c*) The role of flies in the transmission of disease.

PREVENTION AND CONTROL OF COMMUNICABLE DISEASES AND RELATED SUBJECTS

Time: 3 hours

1. Discuss fully the various factors which you would investigate in case of an outbreak of diarrhoea in some of the guests of a summer hotel.

2. (*a*) What is a typhoid carrier?

(*b*) Indicate how a typhoid carrier can be a menace to a community.

(*c*) As quarantine inspector, what instructions would you give to a family resident on a farm in which a case of typhoid has occurred?

3. (*a*) What is meant by a "communicable disease"?

(*b*) Discuss fully how these diseases may be spread from one individual to another, giving examples.

(*c*) Name seven notifiable communicable diseases, stating also the quarantine and isolation periods in each.

4. Two cases of smallpox are reported in a lumber camp. Discuss fully the measures which should be taken for effective control of (*a*) cases and (*b*) contacts.

5. Write notes on the following:
   (*a*) Incubation period.
   (*b*) Importance of birth registration.
   (*c*) Control of bed bugs in a lodging house.
   (*d*) Terminal disinfection.

The Committee on the Certification of Sanitary Inspectors desires to express their appreciation to the members of the five Provincial Examining Boards who so kindly co-operated in the holding of the examinations. In each province the Chairman of the Board was named by the Department of Health and, with the assistance of two or more members, made the arrangements and conducted the examinations, which extend over a period of three days. The Boards of Examiners were as follows:

British Columbia: Dr. J. W. McIntosh, Medical Officer of Health, Vancouver, chairman; Alexander McCulloch, C.S.I.(C.), Assistant Plumbing Inspector, Vancouver; and Mr. John Oliver, Assistant City Engineer, Vancouver. Dr. W. G. Saunders, D.P.H., Medical Officer of Health of the North Vancouver Health Unit, assisted Dr. McIntosh as vice-chairman.

Alberta: Dr. R. B. Jenkins, D.P.H., formerly Medical Officer of Health, Edmonton, chairman; Mr. George E. Cottle, formerly Provincial Sanitary Inspector, Edmonton; and Mr. Dudley B. Menzies, Provincial Sanitary Engineer, Edmonton. To Mr. Cottle the Committee is especially indebted for his services as presiding officer.

Saskatchewan: Mr. J. G. Schaeffer, B.Sc., Provincial Sanitary Engineer, Regina, chairman; Dr. C. F. W. Hames, D.P.H., Provincial Department of Public Health, Regina; and Dr. G. R. Walton, D.P.H., Medical Officer of Health, Regina. Thanks are due also to Mr. A. T. Reid for his valuable assistance as presiding officer.

Manitoba: Dr. A. J. Douglas, Medical Officer of Health, Winnipeg, chairman; Mr. W. P. Brereton, C.E., City Engineer, Winnipeg; and Mr. John Foggie, Chief Sanitary Inspector, Department of Health and Public Welfare, Winnipeg.

Ontario: Dr. J. G. Cunningham, Chief of the Division of Industrial Hygiene, Department of Health of Ontario, chairman; Mr. Hugh McIntyre, A.R.San.I., Provincial Sanitary Inspector, Kenora; and Dr. L. A. Pequegnat, Deputy Medical Officer of Health, City of Toronto. Mr. McIntyre served also as presiding officer. In addition, the Committee is grateful to the following members for their co-operation in the conduct of the oral examinations: Dr. R. D. Defries and Dr. N. E. McKinnon, School of Hygiene, University of Toronto; Dr. J. H. Laurie, Department of Public Health, Toronto; and Dr. J. T. Phair, Chief Medical Officer of Health for Ontario.

Including the candidates receiving the certificate this year, it is gratifying that there are now eighty-one sanitary inspectors holding the Canadian certificate. The Committee desire, however, to draw to the attention of health departments that after January 1, 1939, all candidates will be required to submit evidence of having completed a satisfactory secondary school education. Sanitary inspectors who are at present employed but cannot meet this requirement will have the opportunity of taking the examinations if their applications are received by December 31, 1938. Copies of the regulations, a list of recommended text-books and other references, an application form, and copies of the 1935, 1936 and 1937 examination papers are available on request to the Secretary of the Committee, Dr. J. T. Phair, Canadian Public Health Association, 105 Bond Street, Toronto. The manual of instruction (price $2.00) is also available.